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CERTAIN PUBLIC-HEALTH ASPECTS OF INFECTIOUS DISEASES

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NEW YORK CITY

THERE are at least two ways of viewing infectious diseases; the first is from the standpoint of the individual, and the second is from the standpoint of the community. Curative and preventive medicine usually deals with diseases in individual patients, whereas the handling of them in a community and in relation to environmental factors comes within the realm of public health. In general, each infectious disease shows a characteristic pathogenesis in individual patients, and it is the duty of physicians to have knowledge of this and of how to handle the situation for the benefit of the patients. It is equally true that each infectious disease presents a characteristic pathogenesis in a crowd or in a community, and it is the duty of health officers to know about it and about ways and means of meeting the situation for the benefit of the community. Frequently, it is difficult to determine the point at which the practice of medicine stops and the duties of the health officer begin; many arguments are now in progress concerning this matter. I have no desire to take part in them, for most of them are footless. In passing, however, I should like to register my agreement with Dean Clark's[1] statement: "It is safe to say that at least three-fourths of the preventive work made possible by present-day medical science must be carried by the practising physician." The following remarks are limited to certain public-health aspects of infectious diseases, and emphasis is placed on ecologic phenomena.

Dr. Hermann M. Biggs, who died in 1923 and who is considered by most workers to have been one of the greatest figures, if not the greatest, in the history of American public health, made the remark that public health is purchasable; this subject is discussed in greater detail below. The features of infectious diseases that interest workers in the public-health field are their origin, entry into and spread within a community and their control at a community level. Ideas and methods of handling infectious diseases at times undergo rapid and drastic changes. In fact, revolutionary ideas may occur within the lifetime of a single person. This happened to Biggs, who while a candidate for the degree of Bachelor of Arts at Cornell obtained a leave of absence for a few months to study at Bellevue Hospital Medical College. The influence of that experience is reflected in his baccalaureate thesis, "Sanitary Regulations and the Duty of the State in Regard to Public Hygiene." For the most part, statements in his thesis hold today as well as they did in 1882. However, the accuracy of one remark would be questioned at the present time; in fact, Biggs himself later did much work to show that such a statement was inaccurate. The section referred to is as follows:

> It is now universally acknowledged by all medical authorities that a number of these diseases such as cholera, typhoid fever and diphtheria may be generated *de novo* in certain localities from the use of impure water and the existence of unsanitary conditions, and thence are scattered by contagion; and it is now believed by some of the best medical writers that many if not all of the remainder of these diseases such as smallpox, scarlet fever and measles were originally among the so-called filth diseases, and originated from essentially the same conditions as the others. If this is true we are forced to the conclusion that all of these zymotic diseases the most terrible known to man, that have wrought so much misery, desolation and death in the world are the direct results of man's own carelessness and negligence, the inevitable penalty of the violation of sanitary laws.[2]

In 1885, after Biggs had obtained his medical degree, he and Breneman made a similar statement during the investigation of an epidemic of typhoid fever in Plymouth, Pennsylvania:

> If it be possible for typhoid fever to originate *de novo* in filthy surroundings and in the use of polluted water, no more remote point need be looked for as a starting point of the disease which spread from a single patient in this house to hundreds in the village. . . . Everything points therefore to the conclusion that the disease which spread from this house also originated there.[3]

Before Biggs died it had generally been accepted that bacteria and other infectious agents do not arise *de novo* or spontaneously and that diseases caused by them result only from the entrance of such agents into a host. At the time of his death, the present activity in the study of virus diseases had begun but was not far advanced. If he had lived longer, it is obvious, in view of his early statements regarding the spontaneous origin of certain maladies, that he would have been greatly interested in the

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present-day discussions of the origin and nature of viruses.

Since the discovery of the first filterable virus in 1892, innumerable observations concerning the nature of these active agents have appeared. The outstanding work of Stanley[3] in 1935, which resulted in the crystallization of tobacco mosaic virus, has precipitated another epidemic of discussions, many of which are reminiscent of older arguments concerning the spontaneous origin of mice, worms, flies, bees and bacteria. In fact, a few workers within the last twenty years have contended that they have experimentally produced viruses from normal bacteria or from normal mammalian tissues. None of these experiments have been confirmed or generally accepted. At least most of us account for positive results on the basis of the presence of latent, unrecognized viruses in the so-called "normal tissues" or other biologic materials used in the experiments.

Nature of Viruses

The demonstration that certain plant viruses are crystalline nucleoproteins has left a deep impression upon the scientific world in general and upon the chemists in particular who take the attitude that all viruses are crystalline nucleoproteins. Of course this is not true, but it is difficult to get certain people to believe that it is not. Viruses are not all alike, and they vary greatly in complexity. Some of them are very complex — for instance, the elementary bodies of vaccinia, which have been thoroughly studied, approach the size and complexity of small bacteria. The one characteristic common to all viruses is that they are obligate parasites in the sense that no one has ever induced them to multiply outside a living susceptible host cell.

As a result of recent discussions on the origin and nature of viruses, I have heard it asked: "What is the use of attempting to prevent the spread of virus diseases if viruses are fabricated by their hosts?" Physicians, public-health officers and others interested in public-health problems should not become alarmed or misled by such questions or statements. In spite of a few unsubstantiated claims to the contrary, no case of a virus disease arising spontaneously in a patient has been established. Indeed, all the evidence points to the fact that virus diseases, regardless of the nature of the active agents inducing them, will act in the future as they have in the past — that is, a patient who comes down with a virus ailment will do so because, in some manner, he contracted the infection from without rather than through its spontaneous fabrication within. In other words, when one is developing plans for the control of virus maladies, there is as yet no reason to alter current ideas regarding the importance of obligate communicability in the origin and spread of virus infections.

In view of what has been said, it remains to explain why certain virus diseases of human beings have appeared on the horizon within the last twenty to twenty-five years. This applies particularly to recently discovered virus diseases that attack the central nervous system of man. An obvious answer is that at least some of them had been present for a long time and were not recognized because of the lack of adequate technics. In spite of this obvious answer, it is still strange that St. Louis encephalitis suddenly appeared in 1933 and has not been traced back any farther than to a small outbreak, which occurred in Paris, Illinois, in 1932. Although another epidemic appeared in St. Louis in 1937 and the disease is known to occur sporadically in certain Western States, it has never caused any trouble on the Eastern seaboard. This disease leaves neutralizing antibodies in the blood of patients who recover. Therefore, it is possible to say that human beings in certain parts of the world have not as yet been infected by this virus. Where the virus was before it attacked human beings in 1932 and 1933 is not known. This is a peculiar situation, and there is no adequate explanation for what has occurred. However, one is permitted to speculate concerning the matter, and there are data that enable one to speculate with some hope of arriving at a true answer.

It is characteristic of many viruses to undergo certain changes similar in some respects to those resulting from mutation. Also, a number of viruses possess the ability of adapting themselves to different hosts. Within recent years, seven or eight new viruses have been recovered from wild mosquitoes caught in nature. Most of these viruses are able to attack the central nervous system of experimental animals and to produce encephalitis. There is also evidence that some of the viruses have infected human beings without producing recognizable disease. The evidence for this is the presence of neutralizing antibodies in the blood of certain people living in the areas where the viruses were discovered in mosquitoes. It is conceivable that through mutation, adaptation or change in environment certain viruses, which parasitize only mosquitoes and lower animals, suddenly acquire the ability of producing encephalitis in human beings. Certainly this explanation for the appearance of St. Louis encephalitis is more plausible than one based on the spontaneous fabrication of encephalitic viruses in human beings. Such a statement must not be interpreted as a denial of the spontaneous origin of infectious diseases in the past or of its possibility in the future. However, one can safely say that nobody has yet established the spontaneous origin of a single infectious disease and that regarding such diseases the law of obligate communicability still prevails.

Infectious Diseases in the Community

Etiology

Infectious diseases are caused by protozoa, fungi, bacteria, spirochetes, rickettsiae and viruses. These agents are endowed with life. All living things have

an ecology and those producing disease are no exceptions. Some of the viruses may not be alive, and yet their ecology, if the word may be used in this context, is so similar to that of living things that they may, for the purpose of this discussion, be considered collectively with other infectious agents. The behavior of infectious diseases in a population is nothing more than an expression of conflicts between various forms of life in an effort to arrive at a satisfactory equilibrium.

Studies of epidemics have been going on for centuries and have been fruitful. Only recently, however, have such investigations been brought within laboratory walls so that controlled experiments of certain types could be performed. Most of the work has been done by Topley and Greenwood in England and Webster and his associates in America. It has been conducted on mice as the experimental host and *Salmonella enteritidis* (*Bacillus enteritidis*), *S. aertrycke* (*B. aertrycke*) and the virus of ectromelia as the infectious agents.

A brief account of how those experiments were performed and a statement of the results will simplify the rest of this discussion. If 100 mice, all of which are free from *S. enteritidis*, are placed in a cage of such size that they are considered to be living under crowded conditions, the animals will get along fairly well. However, if several mice infected with *S. enteritidis* are placed in the cage, infection will spread to the healthy mice, and an epidemic will occur. Many of the animals will die and the epidemic will finally come to an end, but the infection will not disappear entirely from the remaining population; it will smoulder along, and an occasional mouse will die. At this stage, the disease is usually spoken of as being endemic. If at this point in an experiment several healthy mice are added to the cage daily, after a number of days a new epidemic will occur involving the healthy mice in addition to some of those that have passed through the preceding epidemic. If the addition of mice is stopped, the epidemic will subside again, but if the daily addition of a sufficient number of mice is continued, the epidemic will also continue more or less indefinitely. Once such a population of mice becomes seeded with infection, it is very difficult to eradicate it. Topley and his co-workers have attempted to inhibit the occurrence of epidemics by vaccination of mice before addition to the colony. According to them it is impossible in this manner to prevent epidemics completely.

It might be profitable to examine briefly the biologic aspects of the observations described above. *S. enteritidis* is a parasitic organism that has difficulty in maintaining itself free in nature; it is more or less dependent upon some host for its continued existence. The experimental epidemics described resulted from a conflict between infectious organisms and hosts. Had *S. enteritidis* killed all the mice, its continued existence would not have been possible. Eventually, a stabilization of infection was effected, at either the endemic or the epidemic level, depending upon the conditions under which the experiments were conducted. Only in this way could the infecting agent and the host have continued to live together.

Frequently, military-training camps have unwittingly been set up and run in a manner that duplicated the experiments in mice described above. Many healthy men were brought together from different parts of the country, and after a time these populations became seeded with pathogenic organisms, whereupon occasional cases of infection began to appear. Then, several times a week for long periods, groups of new, susceptible men were added to the populations in the camps. As should have been expected, epidemics occurred, and in some camps the incidence of certain diseases remained at epidemic levels for many months. This was particularly true of some respiratory diseases, as best exemplified by hemolytic streptococcus infections.

The experiments in mice, which present a relatively simple picture of how infectious agents act in a crowd, represent in a general way what takes place in most epidemic diseases of human populations. In each instance, hosts and infecting agents strive to keep for themselves a place in the world. The conflicts seesaw back and forth over long periods with epidemics separated by more or less quiet endemic periods. In many instances, neither the host nor the invading agent attains complete supremacy, and eventually some kind of truce is called or an equilibrium is reached. An ideal situation would be one in which both the infectious agent and host could survive without much harm to either. Theobald Smith[4] often referred to ideal parasites, which, according to him, are infectious agents that live peaceably with their hosts. In other words, they infect and immunize their hosts without causing much damage while preserving for themselves a safe place in nature.

In certain instances, equilibriums between human populations and infecting agents have been attained but, for many reasons, have been maintained with difficulty. The rapid addition of susceptible persons through birth or immigration to a population in equilibrium with a pathogenic agent sooner or later results in an epidemic. This is best exemplified by measles, which occurs every two or three years in large cities. There are many other ways in which equilibriums can be upset. Many of these are present during periods of war, when large groups of human beings are dislocated and sanitary conditions and standards of living are poor. The changes that occur under such conditions are more comprehensible than the other variations that have been noted in the behavior of certain epidemic diseases. For example, scarlet fever at present is extremely mild in certain parts of the world, but forty or fifty years ago it was a scourge; there had previously been another period when the disease was relatively mild. Such cycles

in several other diseases have been noted, but no one has adequately explained the phenomenon.

Transmission

In general, there are three ways in which infectious agents get from a sick person or carrier to a healthy, susceptible person: by droplet infection, droplet nuclei or contact in respiratory diseases such as measles, influenza and scarlet fever; by means of contaminated water, milk or food or by contact in enteric diseases such as typhoid fever, bacillary dysentery and amebic dysentery; and by means of vectors — for example, mosquitoes in malaria and lice in epidemic typhus. Chapin[5] stressed contact infection; more recently, this mode of spread of infection has not been considered very seriously in many diseases, particularly those in which the infectious agent is found in the feces, such as poliomyelitis, infectious hepatitis and dysentery. My experience with hookworm on Guam impressed me with the fact that most of us and our clothes are at times dangerously contaminated with fecal material. For example, a young infant infected with hookworm was placed on a small cotton blanket for twenty-four hours. At the end of that time examination revealed no obvious fecal contamination, and yet when the blanket was moistened and allowed to stand for five days, 20,000 infective hookworm larvae were obtained.

So far, I have discussed situations in which the relation between the infecting agent and the host has been a direct one and in which the maintenance of disease has involved the ecology of only the infecting agent and the host. The diseases spread by the first two methods mentioned are of this kind. Those spread by vectors are ecologically more complex, because, in addition to the ecology of the host and parasite, that of a vector and at times an intermediate host must be considered. A knowledge of these additional factors is essential for the understanding and control of such epidemic diseases as malaria and murine typhus. Thus, for malaria to flourish in a locality, a sufficient density of Anopheline mosquitoes capable of transmitting plasmodia is essential. This means that the mosquitoes must be able to find suitable living and breeding places and to protect themselves against natural enemies. This is an ecologic problem so far as a mosquito is concerned. Likewise, if murine typhus is to be established and maintained in a community, there must be a sufficient number of rats to act as reservoirs for the rickettsiae and the proper kind of fleas to transmit them from rats to human beings. Thus, the maintenance of murine typhus in a community and its behavior in regard to endemicity and epidemicity depend upon the ecology of human beings, rickettsiae, rats and fleas.

Prevention and Control

The most common methods of prevention and control of infectious diseases in human populations are as follows: quarantine; protection of food, milk and water and other aspects of general sanitation; the eradication or control of vectors, reservoirs and intermediate hosts; and vaccination. In dealing with certain animal and plant diseases more drastic measures have at times been employed — for example, the ruthless destruction of all susceptible hosts within a prescribed area.

So far as many diseases are concerned, the world has just passed through a very interesting period. Certain of them unexpectedly gave trouble, whereas others that had been greatly feared remained in the background. Many procedures for the control of a variety of diseases were instituted, some of which have been publicized as having been very successful; in others much faith was reposed in spite of the fact that there was inadequate evidence to justify such an attitude.

In World War I, epidemics of measles complicated by pneumonia presented serious problems for the United States Army. Most men reared in urban communities had had the disease by the time they joined the military forces, whereas many of those from rural districts had never experienced measles. The epidemics occurred in the susceptible soldiers from rural communities. Between World War I and World War II, good roads and numerous automobiles made much of the United States, so far as measles is concerned, urban in character. Consequently, most of the men who joined the Army or the Navy during the last conflict had had measles prior to their enlistment, and this disease, as predicted by some, was of minor importance.

In World War I, influenza was a major scourge and swept the whole world, killing many millions of people. When World War II broke out, investigators predicted that another pandemic of influenza would sweep everything before it. This did not occur, and influenza proved to be of relatively minor importance. Between the two wars, it was shown that influenza can be caused by at least two agents: influenza A virus and influenza B virus. Furthermore, a vaccine capable of protecting approximately 75 per cent of those receiving it has been perfected and was given to certain military personnel. Even the most ardent advocates of influenza vaccines admit that the prevention of a pandemic during World War II did not depend upon their use. In fact, most workers are reluctant to venture an explanation of what happened. Perhaps I shall be forgiven for suggesting one. Between the two World Wars, rapid transportation of all kinds developed by leaps and bounds, making the world one community so far as influenza is concerned. It has been demonstrated that the two known influenza viruses from time to time produce mild or moderate epidemics here and there throughout the world. In view of this, all populations of the world are probably thoroughly seeded with the two viruses, and something similar to a truce has been declared between them and

human beings. If this is true, we shall continue to have mild and moderate epidemics of influenza but never another pandemic similar to the one experienced in 1918, unless a variant, to which a large proportion of the people in the world are susceptible, suddenly originates from one of the two known influenza viruses.

Unlike measles and influenza, which belong to the respiratory group of diseases and are spread by droplet infection, droplet nuclei and contact, typhoid and paratyphoid fever are members of the enteric group and are usually transmitted by means of infected water, food or milk and by contact. These diseases have played a prominent part in most wars. In the United States Army, however, they were of minor importance in both wars. Compulsory vaccination against typhoid and paratyphoid fever was enforced in the American Army during these wars, and many observers attribute their absence to this procedure. There are still a few workers who believe that typhoid vaccination is of no value. The truth probably lies between these two opinions. It must be remembered that enteric diseases in many countries were well on the way to being controlled long before the use of vaccines. In fact, considerable progress had been made in the control of typhoid fever in England before the discovery of the typhoid bacillus. The control measures consisted of protecting food, milk and water from contamination by enteric bacteria. At the time vaccination was introduced in the American military forces, better sanitation was also provided for the men, even under fighting conditions. In spite of a few contrary opinions, it is hard for me, because of my experience in the Pacific area, to believe that typhoid vaccination as practiced in the American military forces is without value. Nevertheless, from certain things that happened in the Pacific area and in Europe, it is obvious that vaccination in the absence of proper sanitation will not give complete protection against the disease. Members of United States Naval Medical Research Unit No. 2 had an opportunity to study typhoid and paratyphoid fever in troops that took part in the fighting on Okinawa. In all cases studied the men had been adequately vaccinated or revaccinated within a year of the time that they became ill. There can be no doubt of the diagnoses. Some of the infections were severe, but most of them either were mild or had been altered in some way. On questioning, practically all the infected men gave a history of having eaten raw vegetables gathered during combat from native fields that had been heavily fertilized with human feces. These men had obviously become infected even though they had been vaccinated. On the other hand, inspection of the natives and their habits forces the conclusion that many more soldiers would have contracted typhoid or paratyphoid fever had they not been vaccinated. I have been told on good authority that American men detained in some of the German prison camps, where proper sanitation was lacking, suffered from typhoid and paratyphoid fever in spite of having been adequately vaccinated. In a civilian population, enteric infections should be controlled through proper sanitary measures and personal habits. In time of war, particularly in the fighting forces, it may not be possible always to maintain proper sanitation and control of personal habits. Under such conditions, vaccination should be employed, but it must be remembered that even in the armed forces sanitation cannot be disregarded if enteric diseases are to be kept in a position of minor importance.

Each year, malaria is responsible for more sickness and deaths throughout the world than any other disease. The American forces expected malaria in the South Pacific area, but the early handling of the malarial problem in that area was not brilliant. Defects, however, were rapidly rectified, and the problem in the latter part of the Pacific struggle was handled better. When the war ended quinacrine (Atabrine) was still being used for the suppression of the disease. This drug does not prevent infection. Great efforts were made in America and in England to find true prophylactic and curative agents; both countries believe that they have made progress toward this goal. It will be interesting to observe what the new drugs will do toward controlling or eradicating malaria.

Before World War II, great strides had been made in the control of mosquitoes by means of oil, Paris green and freon-pyrethrum mixtures. During the war, DDT was added to the list of insecticides of value for use against Anopheline larvae and adults. The occurrence and persistence of malaria among human beings depend upon the ecology of Anopheline mosquitoes, of which there are many kinds; each one has an ecology of its own. Methods of controlling or eradicating one kind do not necessarily apply to another. Anopheline mosquitoes are not found on certain islands in the Pacific area, and great efforts have recently been made in many directions to prevent their introduction. Much has been said about the success of these efforts. Having spent some time in the South Pacific and Central Pacific areas and having seen how control measures were carried out, I wonder whether they had much to do with the successes mentioned. In any event, these areas remained free for centuries before institution of the control measures. Therefore, I suspect that there is some ecologic reason why Anopheline mosquitoes find it impossible or difficult to establish themselves in one of the areas. Attempts should be made to establish Anopheline mosquitoes on a small, unimportant island. If the results of the experiment were negative, desirable information would have been obtained; if they were positive, it should not be difficult to eradicate the mosquitoes.

I have discussed this matter with a number of people, who usually show little enthusiasm for the

idea that it would be difficult to establish Anopheline mosquitoes on Pacific islands now free from them. They point to the fact that *Anopheles gambiae* was taken from Africa and established in Brazil, an entirely new habitat. They also point out that this mosquito recently spread up the Nile into a territory where it had not previously been found. It is admitted that some Anopheline mosquitoes can establish themselves in new homes, but it must be remembered that others had already found suitable habitats in Brazil and Egypt before *Anopheles gambiae* joined them. Consequently, I do not believe that anyone should state that Anopheline mosquitoes can establish themselves on certain islands in the Pacific area merely because *Anopheles gambiae* was able to find new homes for itself in Brazil and Egypt.

In speaking of recent advances in the fight against malaria, one writer has made the following statement: "But the most important lesson is that malaria can be controlled anywhere in the world, in any environment, when trained and organized personnel are given the necessary supplies and authority."[6] It is true that much can be done in the control of many Anopheline mosquitoes, but the eradication of a species is very difficult. It is an established fact that *Anopheles gambiae* was eradicated from Brazil and Egypt, but it is also a fact that other Anopheline mosquitoes in Brazil and Egypt were not eradicated at the same time. It has been suggested that a recently implanted species might be more easily eradicated than one that had been established for centuries in an area. Thus, one might doubt whether it would be possible or practicable at present to eradicate *Anopheles gambiae* from its well established African home. At least, an effort should be made to ascertain how difficult it is to eradicate Anopheline mosquitoes from a long-established stronghold. The island of Sardinia has been mentioned as a place where such work might be done with profit.

Poliomyelitis came into prominence a little more than a century ago, although it had undoubtedly been present in various parts of the world for a long time. The virus has been found in the nasopharyngeal secretions and feces of patients and contacts. It has also been demonstrated in sewage of communities in which the disease was active and in flies collected in such communities. Since the virus is in feces and since it is admitted that a virus entering the mouth can infect a human being, it is obvious that contaminated water, milk and food can at times lead to outbreaks of the disease. In fact, several epidemics caused by contaminated milk have been reported. In spite of this, most workers in the field believe that the mechanism described above is not necessary for the usual spread of the virus in a population.

As a rule, epidemics of poliomyelitis are not explosive. The disease appears to spread radially from a given point or area, the cases becoming fewer as the distance from the center of the area increases. Furthermore, once someone in a family becomes infected, the family frequently acts as an epidemiologic unit. This type of transmission is not characteristic of diseases usually disseminated through water and milk and is more like those that are spread by droplet infection, droplet nuclei and contact. Since more viruses are found and persist in feces for much longer periods than in the nasopharyngeal secretions, most workers in this field are inclined to believe that through contact of various kinds the virus in the feces of an infected person is transported to the mouths of susceptible people.

As stated above, poliomyelitis became epidemic a little more than a century ago and was noted at that time in certain parts of Europe. It did not become very obvious in the United States until the latter part of the last century, since when it seems to have been increasing in prevalence. It is believed that this is a real increase in the number of obvious cases and is not to be explained by more frequent diagnosis. During this period in the United States many infectious diseases, particularly those due to poor sanitary conditions, have decreased in prevalence. This seems to be a paradox: the cleaner the country becomes, the more cases of poliomyelitis occur.

It is known that the virus of poliomyelitis can induce inapparent infections and a mild disease without paralysis as well as a paralytic disease. In fact, there are only a few paralytic cases in comparison to the other kinds. There are neutralizing antibodies against the virus in 85 to 90 per cent of the adult population tested in the United States. In Africa (particularly in Egypt), China and Japan, it has been shown that at least 85 to 90 per cent of the adult population possess neutralizing antibodies against the virus. In spite of the fact that most adults of these countries possess neutralizing antibodies, very few cases of paralytic poliomyelitis are seen. As is well known, the sanitary conditions are very poor, and the countries are densely populated — a condition enhancing the likelihood of the spread of a disease by contact.

Paralytic poliomyelitis is very rare in young infants, particularly in those under six months of age. It is also known that antibodies against this disease are transmitted from an immune mother to her infant. These antibodies, like those against other infectious diseases, disappear within six to twelve months after birth. If the virus in Egypt, China and Japan is widely distributed and most infants born in those countries are likely to come in contact with the virus one or more times during the early months of life when they are partially protected by antibodies obtained from their mothers, the infants could, through mild unrecognized infections, develop an active immunity that would protect them from a paralytic attack of the disease in childhood

or adult life. Thus, if the circumstances described are true, the populations of Egypt, China and Japan have arrived at a truce with the virus of poliomyelitis. In other words, the people and virus live happily together. If the equilibrium that now exists were upset by a marked decrease in the density of the population or by the institution of sanitary conditions equal to those in the United States, it is conceivable that a sufficient number of infants would not become actively immunized early in life and that epidemics of paralytic poliomyelitis would make their appearance.

Public-health officials will probably take exception to some of the ideas set forth concerning poliomyelitis. Nevertheless, the likes and dislikes of public-health officials cannot change ecologic laws, and in the control of diseases many things must be kept in mind. If a population is in happy equilibrium with an infectious agent, it may not always be advisable to disturb this equilibrium unless the disease can be eradicated, unless adequate methods for prevention of its re-entry into the population are available or unless an adequate method is at hand for its control upon re-entry.

At present there is no means of controlling the spread of poliomyelitis, and there is no vaccine available for its prevention. If the disease is transmitted by contact or if it is air borne, public-health officials cannot, through the passage of sanitary regulations, break the chain of events sufficiently to stop the spread of the disease, because legislation against human contacts and against breathing are not acceptable. It is true that personal habits can be improved through education, and many experiments are under way in which, through ultraviolet irradiation or aerosols, attempts are being made to sterilize the air. The experiments are interesting, but it is not likely that sterile air will be universally available for a long time.

Quarantine, which is the detention in isolation of contacts and patients with diseases, has been one of the measures employed in the past to prevent dissemination of infectious maladies within a country or from one country to another. Much faith has been placed in this method, but most experienced health officers and epidemiologists are well aware of the fact that quarantine as applied to human diseases, because human nature will never permit it to be sufficiently stringent, offers no great barrier to their spread. In many places, for psychologic reasons if not from ignorance, outmoded quarantine is still in effect, resulting in the waste of much time and money. So far as I know, no epidemic of measles, chicken pox, influenza, poliomyelitis, smallpox and so forth has ever been adequately controlled by means of quarantine. The Board of Health of the City of New York is gradually making isolation or quarantine regulations less and less burdensome to its citizens. At present the regulations are very mild and simple, and it looks as though many of them will soon be dispensed with entirely.

Since 1815 a number of pandemics of cholera have occurred. Indeed, the disease has been known to spread to many parts of the United States. At times quarantine measures were very strict. Did they do any good? I doubt it. In any event, Greenwood[7] has made the following observations concerning the value of quarantine measures in controlling this disease:

> As seems so often to be my fate, I must end on a note of interrogation. Why did the Indian variety of cholera acquire a dispersive power a little more than a century ago? Why did it ravage Europe for more than a generation and then lose interest in us? Without going the whole way with Sticker I am prepared to go some distance and to doubt whether the decisions of national and international committees or the blockading of land or sea frontiers have played a much more important rôle than the fly on the wheel.

There is a definite relation between the prevalence and persistence of certain diseases and the sanitary conditions and standards of living. The best way for a country to prevent the entrance and spread of such diseases is to have a civilization and a standard of living that provide poor ecologic conditions for the infectious agents, their vectors and reservoirs. For example, it is not necessary at present to worry about the introduction of cholera and epidemic typhus into the United States, because they would find unfavorable conditions for their establishment and spread.

The statement of Biggs, mentioned above, that public health is purchasable is true within certain limits, one of which is that it cannot be brought alone; there are tie-in purchases, such as the proper kind of civilization and standard of living. Moreover, I strongly suspect that more than one such tie-in purchase has been largely, if not entirely, responsible for specific gains in public-health progress.

Early in the history of this country, malaria was rampant in the Mohawk Valley. It is doubtful whether conscious efforts to do away with Anopheline mosquitoes in that area accomplished much, but, as the fertile land was brought under cultivation, the area became more and more densely populated, with the consequent removal of breeding places for the mosquitoes. Thus, with the advance of civilization, malaria-bearing mosquitoes found ecologic conditions unfavorable for them, and malaria disappeared from the area without any conscious efforts on the part of the inhabitants.

The death rate from tuberculosis in the United States has been decreasing rapidly. Public-health officials and public-spirited organizations have been active, and there is a tendency on their part to ascribe the decrease to their activities. Similar claims have been made regarding many other infectious diseases, as exemplified by the following statement by Grant[8]:

The achievement of health departments in controlling sanitation of the environment and the incidence of communicable diseases with the consequent improvement in mortality rates has already resulted in the well known marked shifts in the age distribution of population and has disclosed the three major lags in medical care; namely, rehabilitation, chronic illness, and mental care.

While health officers and different organizations have been active, many things not directed by them have been happening in the population, and these happenings probably would have occurred in spite of anything that could have been done. I have no quarrel with health officers or with people working in the tuberculosis field, for they have done a good job, but I seriously doubt whether the decrease in incidence of certain infectious diseases and the marked decrease in the death rate from tuberculosis in particular are largely due to their activities instead of resulting from multiple events in the population about which too little is known and over which no one has a great deal of control. Undoubtedly, many of these happenings are in some way related to or controlled by ecologic laws.

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"FEVER OF UNKNOWN ORIGIN" DUE TO LYMPHOGRANULOMA VENEREUM*

Report of a Case with Diagnosis by the Use of Quantitative Complement-Fixation Tests

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LYMPHOGRANULOMA venereum infection is a localized suppurative process involving the inguinal, femoral and pelvic lymph nodes and the rectum. Although systemic symptoms are common in this disease, prolonged fever is rare. This infection is therefore not usually thought of in the differential diagnoses of febrile conditions. Fever, sweats, headache, tachycardia or relative bradycardia, joint and muscle pains, malaise and anorexia are frequent but, as a rule, cause little concern to the patient. Some cases, however, are so severe that the lymphadenitis appears to be of minor importance in the face of a generalized infection. When generalized symptoms predominate and the tell-tale lymphadenitis is not present, the diagnostic problem presented is no less formidable than the solution of a "fever of unknown origin." In this task, the standard laboratory procedures are of little help.

Recently, such a problem was encountered at the Station Hospital, Camp Lee, Virginia, and its final solution was achieved only through the use of a simple laboratory test that has heretofore had little clinical use — the quantitative complement-fixation test.

Case Report

A 33-year-old Negro soldier was first seen at a dispensary on the morning of June 26, 1946, complaining of chills and fever, which had started the night before after an episode of vomiting. He was referred to the hospital and while on the way there he experienced another shaking chill.

Physical examination was negative except for a temperature of 103.4°F., a pulse of 104, and respirations of 24. A smear for malarial parasites was also negative. On the day of admission the temperature dropped to 99.4°F. and remained normal until June 30, when the patient suffered another chill. On the following morning the temperature was 100.2°F., returning to normal during the same day. He remained afebrile and asymptomatic and was discharged on July 8, no diagnosis having been reached.

On September 9 the patient was readmitted with headaches, chills and fever of 1 week's duration. The chills were true rigors, preceded by nausea and vomiting and followed by long welts on the back and buttocks. A carefully taken history revealed that, in addition to the episode in June, two similar attacks had occurred in early January and mid-March. On both occasions the patient had been treated by a physician with pills for 4 or 5 days, after which the fever subsided.

The past history revealed that in 1945 a diagnosis of latent syphilis, which had been treated with the Army 26-week course of Mapharsen and bismuth‡ and also 4,000,000 units of penicillin, had been made. He had served in southern France, but not in any tropical theater, and to the best of his knowledge had contracted neither malaria nor any other tropical disease. The review of systems was negative, and he had never noted inguinal adenitis. The family history disclosed that his mother had died of heart disease at the age of 59; a sister had died of unknown cause at the age of 35, and a brother of tuberculosis at 30.

Physical examination disclosed a healthy-appearing, afebrile, young Negro, who was perspiring more than normal. The pupils were equal and reacted to light and accommodation; the extraocular muscles were normal, and there were no abnormalities of the ears, nose or throat. No cervical adenopathy or thyroid enlargement was noted, and the neck was supple. The cardiorespiratory system was normal except for wheezes throughout the whole left lung field; these were absent on later examination. No murmurs, cardiac enlargement or arrhythmia was found. There was slight protuberance of the abdomen, but the liver and spleen were not

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‡This treatment is as follows: 0.06 gm. of Mapharsen intravenously, twice a week for ten weeks, followed by a rest for six weeks, and then another 0.06 gm. twice weekly for ten weeks. Bismuth subsalicylate, 200 mg. intramuscularly is given weekly for five weeks, followed by rest for five weeks, and then six weeks of bismuth, rest for five weeks and, finally five weeks of bismuth.

enlarged, and the kidneys were not palpable. According to one observer there was slight bilateral inguinal lymphadenopathy, but this was not confirmed by a second examiner. Genital, rectal and neuromuscular examinations were negative. The diagnosis was "fever of unknown origin."

X-ray examination of the chest and analyses of the urine were negative. Examination of the blood revealed a hemoglobin of 12.5 gm. and a white-cell count of 7200. Agglutination tests for *Eberthella typhosa* "O" and "H" and *Salmonella schottmülleri* were positive in a titer of 1:80 but negative for *S. paratyphi, Pasteurella tularensis, Brucella abortus* and *Proteus vulgaris* (OX19). Two smears for malaria and three blood cultures were negative. The total protein was 6.16 gm. per 100 cc., with 4.35 gm. of albumin and 1.81 gm. of globulin (albumin-globulin ratio of 2.4). Repeated white-cell counts on September 23 and 25 were 5400 and 7600, respectively. Repeated urine analyses were negative. The quantitative Kahn test was reported as 4 Kahn units and the Wassermann test as ++.

For the first 4 hospital days the patient appeared well and was helping the ward attendants. On the 5th day the temperature at 8 a.m. was 101°F., and the fever curve assumed an intermittent pattern. There were no rigors, but the patient complained of mild headaches.

In the absence of any diagnosis the patient was seen by officers in the Venereal Disease Section whose opinion was that this syndrome was not due to syphilis, since there were no clinical findings of note and he had been given two adequate courses of therapy. The suggestion was made that a systemic infection with the virus of lymphogranuloma venereum could give such a syndrome. Accordingly, a Frei test was done on September 19, and this was markedly positive in 24 and 48 hours. Blood was drawn for complement-fixation tests, and ++++ fixation was obtained in a dilution of 1:160. Unfortunately, no further dilutions were done at that time and the serum was lost, so that the true titer was not obtained. Sulfadiazine in full doses was started, the presumptive diagnosis being lymphogranuloma venereum.

From the 1st day of sulfadiazine therapy, the temperature dropped and never rose during the 2 weeks in which the drug was administered (Fig. 1). The patient was sent on convalescent furlough on October 4 and returned on October 16, when he was well and had no complaints. Further complement-fixation tests were done to completion at that time, and ++++ reactions were obtained in dilutions up to and including 1:640.

The patient was seen again on November 12. By that time he had gained 15 pounds and expressed the opinion that he had not felt so well the whole year. He had experienced no recurrence of any symptoms, and the ++++ titer was 1:320.

Shortly after this last examination the patient was discharged from the Army. He co-operated by sending two other samples of blood. On January 15 and February 3, 1947, the complement-fixation titers were 1:40.

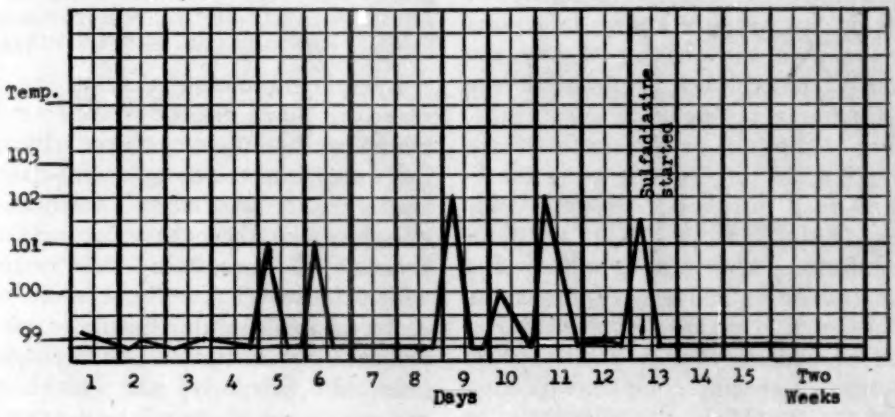

FIGURE 1. *Fever Chart.*

DIAGNOSIS

Four episodes of illness occurred in nine months characterized by chills, fever, diaphoresis and an eruption described by the patient as consisting of welts, each episode being ushered in by headache, anorexia and vomiting. These symptoms and the fever curve were characteristic of a "septic" type of infection. Against a bacterial etiology were the normal white-cell count, several negative blood cultures and negative agglutination tests. (The titers for typhoid and paratyphoid B were those associated with vaccination with "triple typhoid vaccine.") During this diagnostic impasse the possibility of a systemic infection with a specific virus arose, and the diagnosis was made on the basis of a positive Frei test and a positive complement-fixation test. He was then treated with sulfadiazine, and the response was gratifying. Although the therapeutic response is not a specific reaction, the complement-fixation and Frei tests are.

In any group of adult Negroes, a considerable number will be found to have positive Frei tests, various studies disclosing anywhere from 10 to 40 per cent, or more.[1] Thus, the establishment of a diagnosis on the basis of this test alone is hazardous.

The complement-fixation test done in this laboratory uses "Lygranum CF"* from a purified preparation of virus grown on chick-embryo yolk sac.[2] The antigen is a specific antigen and has few side reactions of note.[2] In a survey conducted at this hospital no positive reaction (++++) has been encountered in a serum dilution higher than 1:20 in persons without either clinical lymphogranuloma

*The antigen used in this and related studies was supplied by E. R. Squibb & Sons, through the courtesy of Dr. Charles H. Mann.

or a recent history of the disease. Thus, the initial titer of 1:640 is a highly significant one and cannot be considered a false positive. The high titer is also consistent with the long duration of the illness, and a fall in titer is significant diagnostically, as well as therapeutically, since it occurs frequently after treatment with sulfadiazine. A later sample of convalescent serum was sent to the Virus Laboratory of the Army Medical School, where Dr. Joseph Smadel did complement-fixation tests using a different antigen.* He reported the results as positive in a lower titer (1:32) but was able to ascribe the difference to the use of different antigens.

A diagnosis based on this test raises the problem of infection with a related virus, such as that of psittacosis, the pneumonitis virus of Eaton, the meningopneumonitis virus of Francis and Magill, trachoma and inclusion blenorrhea virus and the virus of mouse pneumonitis (Nigg). The viruses of Nigg and Francis do not produce known infections in human beings, and in the absence of any eye disease, it is hardly possible to incriminate the viruses causing trachoma or inclusion blenorrhea. The absence of any symptoms or signs referable to the respiratory system and the negative x-ray examination of the chest tend to rule out the psittacosis and pneumonitis (Eaton) viruses. In addition, neither of these infections responds to sulfadiazine in such dramatic fashion, nor do they pursue the relapsing course observed in the case reported above. The combination of clinical course, positive Frei test and a high titer of specific complement-fixing antibodies served to establish the diagnosis in this case.

In the past, the diagnosis of these cases was almost impossible early in the disease and could be made only when, after prolonged pyrexia, sometimes extending for over a month, an inguinal mass appeared and suppurated in characteristic fashion. Kornblith[3] reported 2 cases in which this was the sequence of events. In both, there was a septic type of fever of three weeks' duration; the diagnosis was made in one after bilateral suppurative adenitis had supervened and in the other by biopsy of an inflamed inguinal lymph node. D. Luger[4] describes a case of prolonged fever without any localizing symptoms, which was diagnosed as lymphogranuloma venereum by biopsy of a slightly enlarged nontender inguinal lymph node. In each of these cases there was a history of copulation with Negresses. It is also noteworthy that in each case in white men the diagnosis was made on an average of one month after the onset of fever. Other cases have been reported by Giacardy[5] and Chevallier and Bernard,[6] and Stannus[7] speaks of a typhoidal state occurring in this illness.

An interesting series of infections was reported by Harrop, Rake and Shaffer,[8] involving 3 laboratory workers. One handled infected mice, and 2 inoculated mice intranasally with lymphogranuloma virus. In each of these cases there was headache accompanying chills, sweats and a spiking temperature curve; 2 patients had cervical adenopathy. One of these was given an average of 5 gm. of sulfadiazine daily for nine days; the temperature became normal in seventy-two hours, and there were subsequently no residua of the infection. Another patient had a similar clinical picture and was treated for three days with sulfathiazole (27 gm.). This episode was curtailed, but three recrudescences occurred. During the last attack the treatment with the sulfonamide was vigorous (100 gm.), and no recurrences were noted. There was a rise in complement-fixing antibodies in each case, and positive Frei reactions were present. This latter test became negative in the 2 patients who were given adequate sulfonamide therapy while complement-fixing antibodies were still present in declining titers.

*A suspension of washed psittacosis elementary bodies.

Pathogenesis and Clinical Course

Lymphogranuloma infection can occur in varying severity. Some infections are so mild as to be subclinical and are detectable only by the Frei test and by quantitative complement-fixation or virus-neutralization studies.[1] The most frequent forms clinically are those causing inguinal adenitis and proctitis. In these forms the "systemic" signs vary widely in severity, so that some patients are free of fever, malaise and headache, and others are so profoundly prostrated that bacterial sepsis is imitated. Similarly, the lymph nodes may not appear abnormal on physical examination, or they may form an abscess the size of an orange. Thus, any combination of systemic signs and the various grades of lymphadenitis may be present, even the complete absence of both or either.

Histologically, the lymph nodes in this infection show multiple abscesses of varying sizes, which characteristically have a radiate arrangement of the lining epithelioid cells. As the process extends, large accumulations of pus may occur, and when this material is collected and inactivated with heat, it may be used as Frei antigen. When the material or heated cultivated virus is injected intravenously into normal people no reaction is noted, but in infected persons, a temperature rise is noted in twelve to eighteen hours. This reaction was used diagnostically and therapeutically in the past.[9] The fact that material, which is present in the body, is capable of exciting a febrile response suggests a likely method of pathogenesis of the generalized symptoms.

Rake and Jones[10] isolated a fraction from infected yolk and yolk sac that was lethal for mice and postulated that this substance was responsible for the systemic symptoms of this disease. The substance was found in the same fraction that contained the viral elementary bodies, from which it was not separated. It is possible that the "toxic factor" is

inherent in the virus particles in the manner of an endotoxin.

Although the virus has never been isolated from the blood, there is considerable evidence that it can be spread throughout the body by the circulation. Its occurrence in the spinal fluid in patients with inguinal adenitis, but without meningitis, has been described,[11] and meningitis and meningoencephalitis due to this virus has been mentioned in several reports.[12–14] It has been noted experimentally that meningoencephalitis can be produced in mice after intraperitoneal inoculation of virus if the brain is simultaneously traumatized aseptically.[15] It is difficult to conceive of a method of spread in such cases except by the blood stream.

It appears, then, that in the type of infection described above, the virus remains hidden in the body, probably in the lymph nodes, where it may produce anatomic, but subclinical, changes. Periodic release of virus into the blood stream results in symptoms of a general systemic infection similar to those found in bacterial sepsis.

Treatment

Lymphogranuloma may recur unless treatment with sulfadiazine is vigorous and prolonged. Full therapeutic doses cause abrupt remission of systemic symptoms. In Harrop's[8] report, three relapses occurred in a patient who had received sulfonamide for short periods. During the fourth attack, treatment was given for over twenty days, and no recurrences were noted. At this hospital full doses of sulfadiazine (1 gm. every four hours, day and night) have been used for two weeks unless symptoms persist longer. This was the treatment given in the case reported above, and the patient has had no recurrence to date. It is my belief that shorter and less intense courses will be less efficacious.

Discussion

This type of infection is not fatal. However, extension to the brain and meninges or to the bones and joints is possible,[16] and in view of the prompt response to sulfadiazine, it is desirable that the diagnosis be made early. The majority of cases betray themselves after a period of months, but the patients become debilitated, anemic and chronically ill. The essential features of the infection are chills, a temperature with daily spikes of fever, sweats, headaches, a normal or slightly elevated white-cell count and a history of sexual promiscuity. Thus, in all cases of fever of hidden origin, when laboratory aid is sought, this type of infection should be considered. The quantitative complement-fixation test will substantiate or eliminate the diagnosis. The procedure is a simple one and can be done by any laboratory equipped to do Wassermann tests.

Summary

An unusual syndrome caused by the virus of lymphogranuloma venereum is described.

The diagnosis was made by the use of quantitative complement-fixation tests for the virus.

The pathogenesis of this type of infection is discussed.

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THE DISABLED VETERANS OF WORLD WAR II*

Analysis of 600 Cases Examined at Harvard University

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SINCE the termination of hostilities, many sick and wounded veterans have been returning to universities to complete the requirements of their college and graduate-school academic assignments, under the G. I. Bill (Public Law 346) and the Rehabilitation Bill (Public Law 16) of the Seventy-Eighth Congress. The disabled veteran has been epitomized in the press, radio and motion pictures, and although much is sponsored for his good and although many benefits have been provided for him by a generous government, it seems appropriate to call attention to what a group of six hundred disabled veterans in one of our universities represent in the way of disabilities.

Harvard University has negotiated a contract with the Veterans Administration, whereby all students enrolled under Public Law 16 are cared for by the Hygiene Department. The responsibility for the entire health and sickness program provided in this law applicable to Harvard students is delegated to the university health department. It is true that very few doctors appreciate the fact that the students receiving benefits under this law are entitled to free care for medical and surgical conditions, whether service-connected or not, and that each of these veterans is entitled to the free filling of medicinal prescriptions at the pharmacist's, as well as to free eyeglasses and to free medical consultation service. Through the professional staff of the Hygiene Department and through its board of consultants in the specialties of medicine, a complete medical service is provided free for the disabled veteran at Harvard University. The professional fees of the consultant board are computed at the Blue Shield fee-schedule rate and billed to the Hygiene Department, the University being reimbursed by the Veterans Administration. Hospitalization, when required, is provided in the college infirmary for minor medical and surgical conditions, and for major illness or injury at a Veterans Administration Hospital when beds are available or at the general hospitals in Boston affiliated with the Harvard Medical School.

TABLE 1. *Disabilities among 600 Veterans Examined at Harvard University.*

COMBAT-INCURRED DISABILITIES	NO. OF CASES	PERCENTAGE
Bone-and-joint wounds	84	30.0
Superficial wounds	72	25.7
Neurosurgical wounds	27	9.7
Amputations	27	9.7
Frost bite	18	6.4
Thoracic wounds	14	5.0
Abdominal wounds	11	3.9
Plastic-repair wounds	8	2.8
Ophthalmologic wounds	5	1.8
Ear, nose and throat wounds	5	1.8
Urologic wounds	4	1.4
Oral and dental wounds	3	1.1
Vascular surgical wounds	2	0.7
Total	280	

NONCOMBAT-INCURRED DISABILITIES	NO. OF CASES	PERCENTAGE
Medical disease	146	37.9
Orthopedic conditions	87	22.6
Neuropsychiatric conditions	52	13.5
Trench foot	34	8.8
Neurologic conditions	13	3.4
Vascular conditions	10	2.6
Ear, nose and throat conditions	8	2.1
Ophthalmologic conditions	7	1.8
Deafness	5	1.3
Plastic surgery	5	1.3
Dermatologic conditions	6	1.5
Cancer	5	1.3
Abdominal conditions	3	0.8
Dental conditions	2	0.5
Urologic conditions	1	0.3
Thoracic surgery	1	0.3
Total	385	

Multiple surgical diagnoses	27
Multiple medical diagnoses	16
Surgical and medical diagnoses	22
Total	65
Total diagnoses	665
Total cases seen	600

NONCOMBAT-INCURRED DISABILITIES

In an analysis of six hundred consecutive examinations of disabled veterans, it is apparent that a large group of noncombat-incurred disabilities were received in line of duty. With corrections for multiple diagnoses, the noncombat-incurred disabilities represent 60 per cent of the entire group. Perhaps of even greater significance is the fact that 38 per cent

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of these disabilities were due to medical disease (Table 1). Furthermore, an additional 23 per cent — an even greater number of men than that of those who had combat-incurred bone and joint wounds — were caused by orthopedic conditions. Perhaps as the result of screening by the Board of Admissions, neuropsychiatric disabilities do not loom large in this group.

If one considers the noncombat-incurred disabilities from a practical point of view, it is obvious that many of these men have reached the optimum recovery point. Table 2 presents the pathologic entities for which disability compensation has been granted. It is not practical to list all the orthopedic conditions involved in the grant of compensation (Table 3), but pes planus, internal derangements of the knee and back strains represent 50 per cent. Most of the patients are not incapacitated from accomplishing their academic assignments and require no further medical treatment, even though they still receive disability compensation. In other words, the Government appears to be maintaining certain disability allowances beyond the point of necessity. For example, one man has a 100 per cent disability rating for chronic infectious mononucleosis, the most recent symptoms of which occurred sixteen months prior to the most recent physical examination. In the category of noncombat-incurred disabilities, 114 men with medical diseases are receiving $4570 per month in compensation, an average of $39.74 per man, and 50 men with orthopedic conditions are receiving $1394 per month, an average of $27.88 per man — a total of $5964 for these two groups, or an average of $36.15 per man.

TABLE 2. *Noncombat-Incurred Disabilities for Which Compensation Has Been Granted.*

MEDICAL DISEASE	NO. OF CASES
Malaria	35
Cardiovascular disease	34
Gastrointestinal disease	24
Allergy	22
Thoracic disease	12
Rheumatoid arthritis	10
Central-nervous-system disease	8
Diabetes mellitus	1
Acrocyanosis	1
Total	147*

*In 1 case more than one diagnosis was made; hence the actual total of patients is 146.

TABLE 3. *Noncombat-Incurred Orthopedic Conditions Involving Compensation.*

LOCATION	NO. OF CASES
Upper extremity	18
Back	25
Lower extremity	45
Total	88*

*In 1 case more than one diagnosis was made; hence the actual total of patients is 87.

TABLE 4. *Bone-and-Joint Wounds Sustained in Combat.*

LOCATION OF WOUND	NO. OF CASES
Upper extremity:	
Fracture, compound comminuted	39
Joint wound without bone involvement	9
Humerus wound without fracture	1
Total	49
Chest:	
Fracture, compound comminuted, sternum, ribs or vertebra	4
Total	4
Lower extremity:	
Fracture, compound comminuted	41
Joint wound without bone involvement	3
Muscle-tissue wounds	4
Total	48
Total	101*

*There were 17 cases with more than one diagnosis; hence the actual total of patients is 84.

COMBAT-INCURRED DISABILITIES

The largest group of diagnoses of combat-incurred disabilities fall in the classification of bone-and-joint wounds (Table 4). Forty-six of these men are receiving disability compensation totaling $2952 per month — an average of $64.17 per man. Most of them had a compound fracture, with or without serious complicating involvement of the viscera,

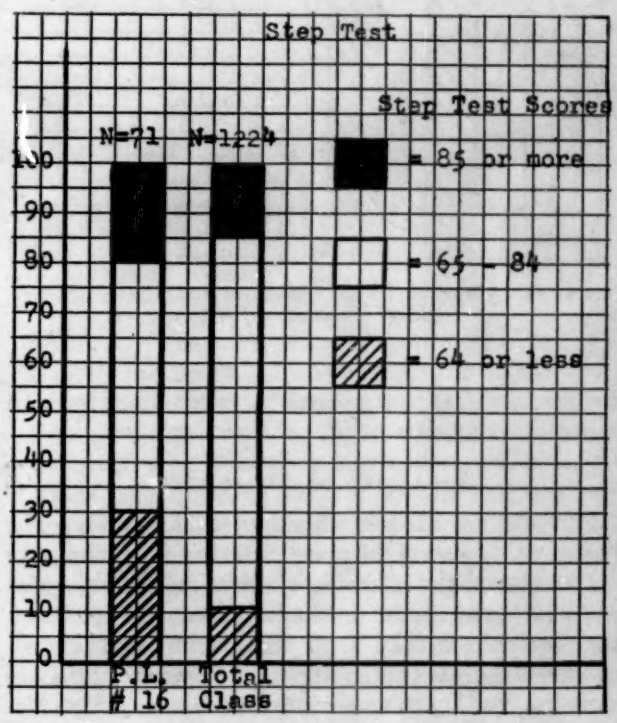

FIGURE 1. *Physical Fitness in Freshman Class, Harvard College (September, 1946).*

nerves or other tissues. Since there are still over 5000 men with battle wounds in Army hospitals today, it is obvious that this group does not represent the most serious types of cases. Active osteomyelitis was a rare finding, only 2 cases being observed among the 84 men with healed compound fractures. Only 1 of these patients required hospitalization owing to a minor recurrent abscess due to a small sequestrum. The men with bone-and-joint injuries and those with peripheral-nerve wounds comprise the majority of patients requiring

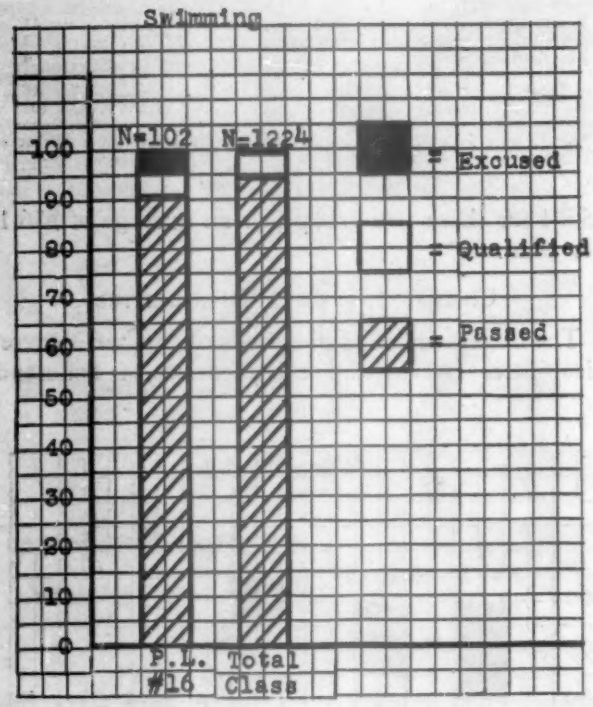

FIGURE 2. *Physical Fitness in Freshman Class, Harvard College (September, 1946).*

further medical treatment, physical therapy and remedial exercise.

APPRAISAL OF DISABILITY

Perhaps an adequate method of appraising the degree of disability of these veterans is to compare the results of the compulsory physical-training program required in the freshman class. All freshmen are required to take a physical-fitness test known as the "Harvard Step Test," in which they are scored according to an accepted standard of normals. A score of 85 or above is rated as excellent, one of 65 to 84, as satisfactory, and one below 65, as unsatisfactory. The 71 disabled veterans had a higher percentage of excellent ratings than the freshman class as a whole (Fig. 1) — an unanticipated finding. As might have been expected, however, a smaller percentage of disabled veterans completed the test satisfactorily, and a greater percentage failed. In the required swimming test, the incidence of those excused for medical reasons among the disabled veterans exceeded by only 3 per cent the figure for the class as a whole, and likewise, the percentages of those qualifying after instruction were reasonably alike in both groups (Fig. 2). In an analysis of the participation of 156 disabled veterans and 1786 normal veterans the incidence of the former who were excused from the compulsory sports program was only 5.4 per cent greater than that of the latter (Fig. 3). Even more significant is the difference of 1.7 per cent in contact-sports participation between the disabled and nondisabled veteran. From these data, it can only be concluded that many veterans classified as disabled have insignificant disabilities. With over 2,500,000 veterans of World War I and World War II classified as disabled, it appears that many of these men have relatively minor or insignificant handicaps.

REHABILITATION

Since corrective exercises are of greater importance than physical therapy in the rehabilitation of men with late convalescent disabilities, the Hygiene Department has developed such a program. Mr. Lloyd C. Harper, who has had considerable ex-

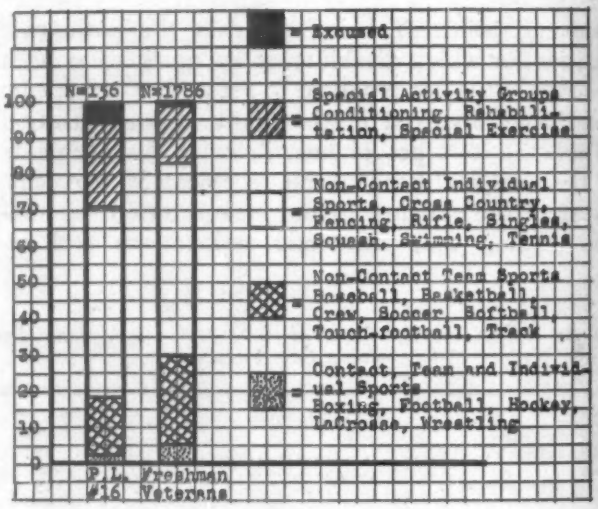

FIGURE 3. *Comparison of Sports Participation between Public-Law-16 Students and Freshman-Class Veterans (Summer, Fall and Spring Terms, 1946–1947).*

perience with the Army reconditioning program, is responsible for these exercises under medical guidance. The Department of Physical Training has provided the gymnasium and has obtained the necessary apparatus and equipment. Individual treatment is afforded all cases at first. With progress in restoration of function, group exercises, including group sports, are recommended. Rowing, swimming, basketball, volleyball and softball are group activities usually provided. There are 10.5 per cent of the 600 disabled veterans now participating in this program.

Those who are familiar with the program of reconditioning and rehabilitation in the Army and Navy hospitals appreciate the values of adequate convalescent care. In returning to civilian life, the severely disabled veteran turns to his family physician, expecting that his permanent disabilities will be treated and improved. Deaver[1] described methods for the rehabilitation to economic independence of the physically handicapped civilian at the Institute for Crippled and Disabled in New York City. Lippman[2] has reported a program of convalescent reconditioning for civilian hospitals. Most hospitals, however, are unable to find space or to obtain the necessary specialized personnel for such an undertaking. Aitken[3] has described an outstanding medically supervised program of rehabilitation, limited in its clientele, for the civilians of New England. Large communities need facilities for rapidly restoring convalescent disabled civilians to gainful occupations. The patient in late convalescence from a serious disability today is the forgotten patient in civilian practice. The rewards of adequate recovery are immeasurable. To increase the average annual wage of 44,000 handicapped retrainees under the 1944 training program of the Office of Vocational Rehabilitation from $148 to $1768 is a noteworthy accomplishment.[4] A similar program would restore a large part of our society — reported to number over 20,000,000[5] — from dependency on state, county or city charity to economic independence and productivity.

Summary

A study of 600 disabled veteran students in Harvard University demonstrated that 60 per cent of the disabilities are noncombat-incurred and do not cause interference with the pursuit of academic assignments, that a comparison between the abilities of the disabled veteran freshman and those of the class as a whole to participate in compulsory-exercise programs demonstrates an insignificant percentage variation between the two groups, and that the 10.5 per cent of this group requiring further rehabilitation is taking part in a medically supervised remedial-exercise program.

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TOXIC EFFECTS OF GASES AND VAPORS*

Mechanism of Poisoning by Volatile Solvents

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ACCIDENTAL poisoning as a result of the inhalation of toxic gases or vapors is encountered with discouraging frequency. The number of reports in the current literature suggests that the incidence of such poisoning is on the increase. The basic reason for this rise is the recent, rapid increase in the development and industrial use of volatile organic solvents. Unfortunately, accurate statistics concerning these cases are not available in this country for a variety of reasons. The reporting of occupational disease is encouraged by the Commonwealth of Massachusetts, but is not mandatory; complete statistics are therefore not available from this source. Compensation-board records are not too helpful, since their opinions and findings are frequently not accompanied by sufficient objective evidence to permit an evaluation of the cases in question. Furthermore, there is no way to determine the incidence of accidental poisonings occurring in the home, which may not be recognized or, if recognized but not fatal, are usually not reported. The situation regarding determination of the incidence of such poisoning is roughly similar in other states, some being slightly better and many far worse than Massachusetts.

It is believed that many illnesses resulting from the inhalation of toxic gases or vapors are ascribed to other causes. Failure to recognize the etiologic role played by a toxic agent in a given illness stems from a variety of factors. The syndrome produced may resemble in every particular one of several common organic diseases with which the physician is more familiar. The patient is frequently not aware that the air he is breathing contains a noxious agent, and fails to associate the breathing of some odd-smelling but essentially nonirritating air with the occurrence of illness ten days or two weeks later. Many physicians do not appreciate the importance of the respiratory tract as an avenue for the absorption and elimination of large doses of

*Part of a symposium on industrial medicine presented at the annual meeting of the Massachusetts Medical Society, Boston, May 20, 1947.
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many toxic agents, and either do not elicit a history of exposure or do not recognize the significance of such a history. It is perhaps advisable, therefore, to present briefly some of the basic principles involved in the absorption of toxic gases and vapors, before consideration of the type of poisonings that commonly occur and are believed to be unrecognized in many cases.

TABLE 1. *Effect of Solubility on Blood Concentration and Total Body Content.**

SUBSTANCE	COEFFICIENT OF DISTRIBUTION	BLOOD CONCENTRATION AT EQUILIBRIUM	TOTAL WEIGHT IN BODY
		mg./liter	*gm.*
Carbon disulfide	2.5	0.25	0 0175
Ethyl ether	15.0	1.5	0 1050
Ethyl alcohol	1300 0	130.0	9 1000
Methyl alcohol	1700 0	170.0	13 9000

*Air concentration, 0.1 mg. per liter.

ABSORPTION AND ELIMINATION OF GASES AND VAPORS

As air containing a noxious agent is inhaled, some of this air reaches the alveoli. The air in the alveoli comes into virtually complete equilibrium with the blood almost instantly. This, of course, results in a marked lowering of the concentration of the substance in the alveolar air as the blood concentration rises, and less of the toxic agent is exhaled than was taken in. The blood leaving the lungs contains an appreciable amount of the toxic material, which it in turn gives up to the tissues, until blood and tissues reach equilibrium with one another. As the above process is repeated, the capacity of the blood and the tissues to take up more of the agent at the pressure maintained in the alveoli is gradually exhausted, and consequently the venous blood returning to the lungs gradually contains more of the gas or vapor, in solution, so that smaller amounts can be absorbed into the blood from the alveoli and a state of equilibrium — saturation — is gradually approached. When this occurs the body contains as much of the gas or vapor as it can hold in equilibrium with the concentration existing in the inspired air. Under these conditions, the expired air will contain as much of the substance as the inspired air, and additional absorption will occur only as the material already in the body is metabolized or eliminated via other channels.

The actual amount of a given substance that the body can contain when in equilibrium with a given air concentration is quite variable, depending essentially on the solubility of the substance in blood and tissue. It may be expressed in terms of the coefficient of distribution, which may be defined as the ratio of the weight of gas or vapor in equal volumes of air and fluid that are in gaseous equilibrium. A substance that is relatively insoluble in blood or tissue has a low coefficient of distribution, whereas one highly soluble in blood or tissue has a high coefficient (Table 1). The solubility of the substance in blood or tissue also influences the total amount of the substance entering the body; an average-sized man in equilibrium with air containing 0.1 mg. per liter of carbon disulfide will contain a total dose of slightly less than 20 mg. of carbon disulfide, whereas a man in equilibrium with the same air concentration of methyl alcohol will contain nearly 14 gm. of this substance, or about seven hundred times as much.

Equilibrium is approached rapidly with the relatively insoluble substance, only a small amount of which is required to saturate the body, but is approached slowly with the highly soluble substance, since a large amount is required. Elimina-

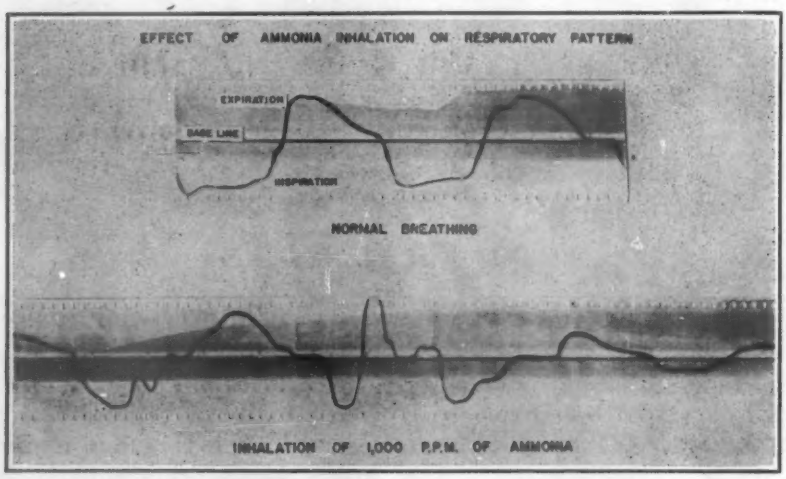

FIGURE 1. *Representative Respiratory Pattern of a Subject Exposed to 1000 Parts of Ammonia per 1,000,000 Parts of Air.*

The upper record shows the normal response, and the lower that after exposure to ammonia.

tion of substances from the body via the lungs occurs as the reverse of absorption, once exposure is discontinued. The situation is analogous to the filling and emptying of tanks of various sizes through a pipe, the size of the tank representing the solubility of the material in the body and the diameter of the filler pipe the rate of exchange between alveolar air and blood. If the substances have a low coefficient of distribution, the tank is small; equilibrium is achieved rapidly, and elimination via the lungs takes only a short time. If the substances have a high coefficient of distribution the tank is large; equilibrium requires many hours of exposure, and elimination is correspondingly protracted. Some of these absorbed substances, however, are either eliminated by other channels or metabolized in the body. This is analogous to the situation existing when one fills a tank with an open drain — it takes a long time to fill it, but emptying proceeds rapidly.

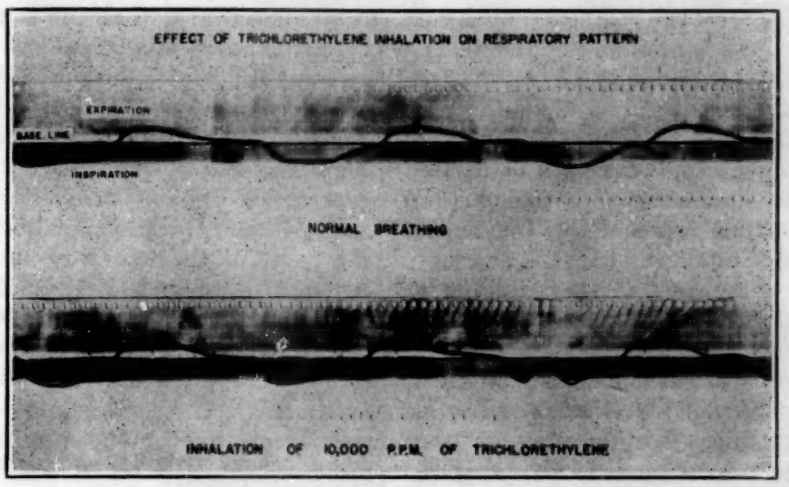

FIGURE 2. *Representative Respiratory Pattern of a Subject Exposed to 10,000 Parts of Trichlorethylene per 1,000,000 Parts of Air.*

The upper record shows the normal response, and the lower that after exposure to trichlorethylene vapor.

Exposure to many toxic gases and vapors is self-limiting because of the unpleasant and irritating effects produced by their inhalation. Serious poisoning due to the prolonged inhalation of such agents occurs infrequently, because the exposed person usually removes himself voluntarily from the unpleasant atmosphere. Many other agents are not unpleasant to breathe in concentrations that are capable of producing serious injury to health, so that a person may undergo a sufficiently prolonged exposure to permit the absorption of amounts of the gas or vapor that will produce injury to the body. One of the factors that appears to determine whether a given exposure will be tolerated or will be voluntarily discontinued is the production of sufficient irritation of the respiratory tract to upset the normal breathing pattern. To determine the mode and type of interference with the breathing pattern, a series of experiments was carried out in which human subjects inhaled ammonia or trichlorethylene vapor from a large glass-lined tank through a rubber facepiece. The concentrations in the tank were achieved by complete evaporation of an amount of trichlorethylene or concentrated ammonium hydroxide that produced the desired concentration in the volume of air contained by the tank. The tank was connected to the subject's breathing mask by a system of valves that permitted rapid switching from room air to tank air without interruption of the breathing cycle.

The respiratory pattern was recorded by means of the pneumotachograph developed by Silverman,[1] which indicates the rate and volume of inspiration and expiration by recording the instantaneous pressure differential created by air flow through a fine mesh screen inserted in a breathing mask. The resistance to respiration of this device is negligible. A representative respiratory pattern of a subject exposed to 1000 parts of ammonia per 1,000,000 parts of air is presented in Figure 1. The upper record is the normal pattern, whereas the lower is the response following exposure to ammonia. It is evident that the breathing pattern is considerably altered. In general, exposure to an irritating gas such as ammonia resulted in coughing, reduction in the depth of inspiration and restraint of breathing. The subjects wished to avoid any further exposure. The breathing pattern after exposure to 10,000 parts of trichlorethylene per 1,000,000 parts of air (1 per cent by volume) is presented in Figure 2. Again, the upper record represents the normal curve for the subject, and the lower shows the response following exposure to trichlorethylene vapor. There is no essential difference between the two patterns;

in fact, they could almost be superimposed except for the occurrence of a swallow during the third inspiration. This lack of any significant alteration in respiratory pattern was accompanied by a subjective willingness to continue the exposure, despite the rather strong sweet odor noted at this high concentration.

This failure to alter the breathing pattern and willingness to continue exposure to a concentration of a chlorinated hydrocarbon that approaches the anesthetic level is considered most significant, since far lower concentrations (500 parts per 1,000,000) are capable of producing organic damage following prolonged or repeated exposure.[2] It is not surprising, in the light of these observations, that dangerous exposures with the absorption of sufficient material to cause serious damage to the body may proceed without any awareness or recollection on the part of the patient. Such exposures will be avoided only if the patient is aware of their possible consequences, or if others who are aware of them make such exposure impossible.

At present the medical profession and industrial hygienists are well aware of the hazard associated with many solvents, and serious poisoning from these sources is occurring less and less frequently. For example, carbon disulfide and benzene no longer menace the health of workers as they did ten or twenty years ago, since the hazards are recognized and controlled.

New solvents and volatile chemicals, however, some of which may be capable of causing serious illness, are constantly being introduced in industry and to a lesser extent turned loose on an unsuspecting public. These illnesses will be attributed to the agents producing them only if the profession is alert to the possibility that a given illness has developed as a result of exposure to a toxic agent. Therefore, one should be aware of the general type of symptomatology and findings that may follow exposure to toxic gases or vapors, especially conditions developing after exposure to agents that are not unpleasant or irritating to breathe: the victim may fail to remember having been exposed and probably will not spontaneously disclose a history of exposure since, in his opinion, the disease he is suffering from is unrelated.

Disease of the liver or impairment of blood-cell formation has long been associated with solvent vapor exposures. The possibility of a toxic exposure is therefore usually thought of and investigated in patients with unexplained jaundice or with anemia or leukopenia. Many toxic vapor exposures may fail to give either of these reactions, however, resulting instead in the development of a nephritis that clinically is readily mistaken for ordinary glomerular nephritis. Since many physicians are not aware of the frequency of toxic nephritis due to single or multiple exposures, they may fail to inquire about previous exposure in a patient with evidence of renal disease, when they would go to considerable lengths to determine such exposure in a patient with anemia or evidence of seriously impaired liver function. The failure to associate nephritis with toxic injury is rather surprising, since many cases of acute toxic nephritis have been reported following the inhalation of carbon tetrachloride.[3–5] Other agents are also capable of producing kidney damage. For example, an acute toxic nephritis recently occurred in a fifty-three-year-old shipping clerk who had undergone relatively brief but severe exposure to a solvent mixture containing 80 per cent toluene. This case was almost dismissed as one of acute glomerular nephritis, since the patient did not at first remember his exposure. The possibility of a toxic nephritis was considered when it was determined that he might have been exposed to carbon tetrachloride. When it was discovered that the solvent vapor to which he was exposed was 80 per cent toluene and 20 per cent ethyl acetate, the possible toxic nature of the kidney disease was almost dismissed, for toluene and ethyl acetate are not generally associated with the occurrence of nephritis. The facts that toluene exposure is capable of producing renal lesions in animals[6] and that the exposure was related to the onset of the nephritis and to the subsequent course of this illness were finally accepted as sufficient evidence to justify a diagnosis of toxic nephritis due to toluene. This case is cited to emphasize the fact that nephritis may occur as a result of serious exposure to toxic gases and vapors, even though the agent in question has not previously been recognized as being capable of inducing such a syndrome in man.

Such cases will be correctly diagnosed only if the medical profession considers the possibility of a toxic agent in cases that appear to be glomerular nephritis, obscure anemias or atypical liver disease. The possibility of any exposure to a toxic gas or vapor should be investigated in every such case, and if any suggestive history is elicited, the circumstances should be investigated thoroughly and the nature of the gas or vapor determined accurately. Finally, the fact that a given syndrome has not previously been reported as resulting from the agent in question does not rule out the possibility that such cases have occurred and gone unrecognized.

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MEDICAL PROGRESS

RADIATION THERAPY

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THE basic principles of radiation therapy have undergone no radical changes during the last five years. The science of physics has contributed fresh means of accomplishing what the radiation therapist has always attempted: maximum selective destruction of the tumor with minimal damage to the normal tissues. These new contributions include apparatus for the generation of extremely high as well as extremely low voltages. The term "supervoltage," which once designated a charge of 400,000 volts, must now be applied to voltages in the range of 1,000,000 to 100,000,000. These powerful rays have the advantage of greater penetration, whereas the units of extremely low voltage have correspondingly low penetrability and are comparable in action to radium.

The development of the atomic bomb has provided a large supply of radioactive isotopes, formerly produced in small quantities by the cyclotron. These elements are now being used extensively as therapeutic agents; only time will evaluate their efficiency in the treatment of disease. The recent development of the betatron has initiated the experimental phases of therapy by means of high-energy electrons.

Large amounts of radiation are necessary for cancerocidal effect on tumors, notwithstanding damage to the skin and surrounding tissues. The injurious changes to structures in the path of the radiation become relatively unimportant as compared with the prime objective of tumor destruction. It is with this in mind that newer methods of radiation therapy are being evolved to accomplish maximum tumor destruction without ultimately damaging normal structures.[1] To approach this ideal, a proper perspective of tissue tumor sensitivity and the consideration of portals of treatment and physical factors are essential.

The previous methods of expressing the dosage in air or on the skin surface were both confusing and unsatisfactory. More recently the measurements of so-called "tumor dose" have given a more accurate description of the amount of radiation delivered to the center of the tumor. Quimby[2] and others[3–5] have provided many of the physical data for the compilation of these measurements. In addition, radium dosages are now expressed in gamma roentgens (γ r), giving a measurement comparable to that based on the roentgen (r), which is used in x-ray therapy. The earlier method of expressing doses in milligram or millicurie hours did not take into consideration the bulk of the tumor.

Tumor doses vary with different tissues. Warren[6] has noted variations in the response of tumors to irradiation. These tumors have been divided into the following groups: radiosensitive, radioresponsive and radioresistant. Warren[7] states: "Radiosensitive tumors are not necessarily radiocurable. Often they are not, recurring in a resistant form after the initial regression." Certain radioresistant tumors, on the other hand, can be cured by adequate irradiation.

BREAST

Carcinoma

Martin[8] states that only 25 per cent of all patients with carcinoma of the breast can hope for surgical cure. The remaining 75 per cent must therefore receive some form of radiation therapy.

The indications for radiation treatment of this disease are intimately associated with the criteria for operability. Radiation therapy is theoretically not indicated in cases that are operable. The criteria for operability have been fully described by Haagensen and Stout.[9] Borderline cases may be subjected to surgery, and some investigators[10, 11] believe that these patients require postoperative therapy to ensure optimum results. The regions treated under these conditions include the immediate areas of lymph drainage — namely, the axilla, the supraclavicular and infraclavicular regions and the mediastinum.

X-ray therapy is the method of choice in the treatment of inoperable carcinoma of the breast.[8, 9, 12] Lenz[12] emphasizes the value of large cancerocidal doses and employs tumor doses as high as 6000 to 8000 r, which are given through multiple portals to the breast and axilla. When a dose of less than 5500 r was given, the tumor was not grossly eradicated. In his series of 48 patients treated with 6000 r or more, 10 were clinically free of disease five years later. Martin[8] treats inoperable breast neoplasms with interstitial radium-needle implantation to lessen the danger of pulmonary fibrosis, which may occur with roentgen therapy.

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Uterus

Carcinoma of the Fundus

Carcinoma of the uterus can be treated by surgery, irradiation or a combination of both. Meigs[13] states, "There is no doubt that nearly all workers in this field believe that the combination treatment is most satisfactory." Corscaden[14] believes that the rate of five-year cures can be increased to 80 per cent with the combined method. Heyman and Benner[15] reported the largest series treated by irradiation alone. They gave their relative over-all cure rate as 64.9 per cent. The rate with radiation therapy alone depends on the uniform distribution of the radiation to the tumor. Many methods have been devised to obtain this effect.[16–18] Heyman et al.[19] pack the uterus with radium capsules, and their results show that excellent distribution is thus obtained.

The technic generally advocated is diagnostic curettage, followed by the immediate implantation of radium in cases of cancer.[19–22] The dose is carefully planned for each patient. Four to eight weeks later, surgical extirpation is performed in patients who are considered good surgical risks. If surgery is contraindicated curettage is repeated, and radium is reapplied if necessary.

Miller and Henderson[22] have reported 77 per cent five-year cures and 65 per cent ten-year cures from the combined method of treatment. Scheffey and his associates[21] give a five-year survival rate of 90 per cent for patients receiving adequate surgical treatment and irradiation by a planned technic.

Benign Uterine Bleeding

Radiation therapy for benign bleeding at the menopause must always be preceded by diagnostic curettage to rule out cancer. Irradiation does not replace surgical procedures, but it has a definite place in the treatment of menopausal uterine bleeding. Some of the indications for irradiation rather than surgery include poor surgical risks, refusal of major operation and pathologic states elsewhere in the body. Irradiation is contraindicated in myomas larger than the size of a grapefruit and extending out of the pelvis into the abdominal cavity, and in young patients for whom myomectomy is possible.[23] Radium is contraindicated in patients with submucous fibroids because necrosis may occur, causing persistent bleeding; x-ray therapy, however, may be used in these cases. Crossen and Crossen[24] have treated 526 cases of bleeding due to uterine myoma with radium, attaining successful results in 490 cases (93 per cent). Schmitz and Towne[25] have successfully treated 412 cases with either x-ray or radium. Of the many methods proposed for the treatment of benign uterine bleeding, radiation therapy is one of the most valuable because of the excellent results and the absence of mortality or morbidity.

Carcinoma of the Cervix

Carcinoma of the cervix is the most frequent malignant tumor of the female genital tract. Irradiation has one of its greatest fields of usefulness in this type of lesion. At the present time, there is a tendency to avoid accepted irradiation methods and to perform surgery. There is no doubt that surgery has a definite place in the therapy of carcinoma of the cervix in the very early lesions, with the carcinoma in situ or well localized. If the carcinoma is advanced, surgery becomes an extremely formidable procedure of doubtful value.

In recent years the earlier detection of carcinoma of the cervix has become possible with the vaginal smear,[26] and therefore treatment by either irradiation or surgery produces a much higher percentage of cures. Most patients, however, are first seen when the lesion is moderately advanced, and it is in these cases that irradiation is the treatment of choice. Anspach[27] states that in advanced lesions radical hysterectomy is a difficult procedure that can be performed only by a few highly trained and skillful gynecologists, whereas with irradiation there is practically no primary mortality and a minimum of morbidity. Irradiation can be used in the treatment of all carcinomas of the cervix regardless of their extent, with a large percentage of cures, in the earlier stages. It also effects good palliation in the very late stages, occasionally producing cures even in these cases. The results with supervoltage therapy in the advanced stages of the disease have not yet been fully evaluated.

Many methods of irradiation for carcinoma of the cervix have been advocated. The accepted procedure is to give intensive irradiation to the local lesion, usually by means of radium and protracted external x-radiation to the pelvis for disease in the parametrium. Most methods employ intrauterine and vaginal applicators. The intrauterine applicator is usually a tube containing several capsules of radium. The vaginal applicators include corks, plaques or colpostats containing radium capsules and placed against the cervix and in the lateral fornices. These provide effective intensive irradiation to the diseased cervix and parametrium.

Kaplan and Rosh[28] favor external irradiation followed by radium implantation and a subsequent course of external treatments. Elkins[29] and Bouslog[30] advocate intravaginal x-ray therapy combined with external therapy. Others[31, 32] use interstitial radium-needle implantation. Each method has its advantages.

Buschke and Cantril[33] do not follow a preconceived outline for treatment or a rigid technic. They write:

> Radiation therapy of cervical cancer has become one of the cornerstones of clinical radiation therapy. This supersedes surgery and is accepted as the superior procedure of choice because, in the overwhelming majority of cases, it accomplishes more with less risk if properly used.

OVARY

There are many types of tumor of the ovary, both benign and malignant, but their classification is difficult because even today extremely little is known of their histogenesis. Meigs[34] has outlined a classification according to the origin, whereas Cutler, Buschke and Cantril[35] classify these tumors according to the type of proliferation. The malignant neoplasms are either solid or cystic. The latter are more frequent as well as relatively more radiosensitive than the former.

Most investigators agree that the proper treatment of carcinoma of the ovary is surgical extirpation of as much of the neoplastic tissue as possible, followed by an adequate course of radiation therapy. Kerr and Einstein[36] believe that postoperative irradiation should be given after the removal of as much neoplastic tissue as possible.

SKIN

Carcinoma

The local treatment of certain superficial skin diseases with radioactive phosphorus (P_{32}) has been suggested by Low-Beer,[37] who soaked blotting paper in measured amounts of the solution and applied it to the skin surface, studying the effects of beta-particle radiation on the skin. Howes and Camiel,[38] Smithers[39] and others[40, 41] discuss the value of low-voltage short-distance ("contact") x-ray therapy in the treatment of accessible superficial neoplasms. They believe that this method is of distinct advantage because the radiation is limited to the tumor and its immediate vicinity, the treatment time is short and the ultimate cosmetic result is excellent. Contact therapy is not applicable to bulky or inaccessible lesions. Strandqvist[42] and Ahlbom[43] have correlated the relation between total dosage and the treatment period and have charted the optimum tumor dosage for the desired number of divided doses over a given time. Hale and Holmes[44] compare the results obtained by the massive single-dose method and multiple treatments within the period of one week. They conclude that a dose of 2700 r given at one time produces essentially the same results as multiple doses totaling 4500 r delivered over a period of a week.

Warren[6] emphasizes the value of intensive therapy for skin cancer. He noted recurrences in the deeper layers, whereas the superficial portions healed with inadequate initial treatments. Young[45] points out that when recurrence follows either adequate or inadequate primary irradiation, radical surgical extirpation should be done.

LYMPHOMAS

The experience of Reinhard et al.[46] at Washington University shows that radioactive phosphorus is ineffective for the lymphoma group of diseases. X-ray therapy is considered more desirable than radioactive phosphorus and avoids the dangerous effects of that agent. Graff, Scott and Lawrence[47] made similar observations on experimental animals, demonstrating deleterious effects on the bone marrow and peripheral circulation with radioactive phosphorus. Any selective effect on tumor cells is greatly offset by the damage to the normal elements of the lymph and blood. The treatment of lymphomas is best carried out with x-rays at 200 kilovolts. The intensity and dosage vary according to the extent of treatment.[48, 49] Desjardins[50] favors the use of moderately high voltages (around 140 kilovolts) and gives courses of treatment at intervals of several weeks.

When the disease is localized in a single small group of lymph nodes, the dosage should be in the range between 2000 and 3000 r.[49] Surgery has even been suggested for the freely movable, small mass of nodes.[51] Unfortunately, most patients are first seen in the advanced stages of the disease, when multiple groups of nodes are involved. When lymphoblastoma involves the spleen, mediastinum and lymph nodes, the treatment must be fitted to the individual patient. An acceptable rule is to give sufficient irradiation to cause complete regression of the nodes, with an additional 25 per cent for the residual microscopic tumor cells. This usually means a dose of 600 to 1800 r. Although larger doses can be administered, it is wiser to obtain a full effect with moderate doses. This procedure permits the administration of additional roentgenotherapy to the same areas later on when recurrences take place in other nodes. When a mass of nodes has been treated, incomplete disappearance does not mean failure of response. The replacement of disease by fibrosis often results in some residual enlargement. X-ray therapy is needless for enlarged fibrosed nodes and results in an expenditure of radiation that may be required in the event of future recurrence in the same regions. It must be recognized that the patient will become radioresistant, which usually indicates the terminal stages of the disease. Carefully planned irradiation often prolongs the period of radiosensitivity of the disease. The treatment of the acute forms of Hodgkin's disease is unsatisfactory at best. This consists of spray radiation or small amounts of irradiation over large surfaces of the body.

Nitrogen mustard has proved effective in isolated cases, but its use in routine therapy is considered unjustified.[52]

PHARYNX, MOUTH AND SINUSES

Larynx

The necessity of adequate cancerocidal doses for laryngeal carcinoma is stressed by Lenz,[53] who administers tumor doses varying from 5700 to 7000 r. In the presence of metastases to the lymph nodes, surgery is advocated when the nodes are freely movable. Otherwise, x-ray and radium are recom-

mended. Arbuckle[54] states that the surgical removal of the thyroid cartilages allows large amounts of x-ray therapy to be given without danger of chondronecrosis. Cutler[55] describes a method of concentrated radiotherapy, employed in the presence of radioresistant tumors of the larynx and pharynx. In this method the tumor is treated for a comparatively short time with large daily doses. This is in contrast to the Coutard method, in which small daily doses are given over a long period. Cutler[56] also diminishes the size of the field as treatment progresses, thus gaining the greatest concentration at the center of the tumor. The tumor doses vary from 5700 to 7700 r. The use of small fields, he states, is a definite advantage, allowing greater tumor doses with less effect on the surrounding normal tissues. This has also been pointed out by Blady and Chamberlain.[57]

The problem of surgery versus radiotherapy is discussed by Campbell,[58] who agrees that either form of treatment can be effective in the early stages of the disease. Radiation therapy is considered preferable in the early cases because the larynx is preserved, if proper and adequate radiation is given.[35, 53]

Nasopharynx

Carcinoma of the nasopharynx is treated either by x-rays or a combination of x-rays and radium. Lenz[59] has shown five-year survival free of disease in 13 of 44 patients treated. It is interesting to note that 6 of these patients had lymphoepithelioma, which is an unusually radiosensitive tumor. Only 2 of these tumors were epitheliomas, slightly differentiated. Lenz considers the extent of disease and degree of bone involvement to be important factors in the prognosis. The presence of metastases is naturally of grave significance.

The use of radium therapy on lymphoid tissues of the nasopharynx was brought into prominence during World War II. The procedure was used successfully in the Air Forces to eradicate excess lymphoid tissues about the eustachian tubes.[60–62] Radium application and x-ray treatment of the lymphoid tissue of the nasopharynx are of value for deafness secondary to excess lymphoid tissues in the naropharynx, infection of the middle ear and chronic otorrhea.[63–65]

Tongue

Richards,[66] of Toronto, discusses radiotherapy in carcinoma of the tongue. He obtained three-year survival in 50 per cent of all cases treated. His treatment consists of external roentgen-ray therapy at 400 kilovolts, with a minimum tumor dose of 5500 r. When half the external dose has been given, intraoral radiation with 200 kilovolts is started and 3000 r is administered, so that the final tissue reaction is a summation of the external and intraoral irradiation. Residual carcinoma is treated with interstitial radium, low-content (2-mg.) needles being used.

Lip

In carcinoma of the lip, the primary lesion may be controlled by irradiation or surgery, but the attack on metastatic lymph nodes in the neck is best carried out by radical dissection.[67] Routine prophylactic removal of the nodes is not recommended, but a careful follow-up study should be instituted. The early detection of nodes and prompt surgery give good results. When cervical metastases are too extensive for surgical removal, external irradiation together with radium seeds may be used. Schreiner and Christy[68] reported a series of 636 patients with cancer of the lip treated by x-rays or radium or both. They obtained an absolute cure rate of 58.9 per cent. The treatment of metastatic cervical lymph nodes by x-ray and radium therapy has been carried out with encouraging results by H. E. Martin[69] and C. L. Martin.[70]

Maxillary Sinuses

Cancer of the maxillary sinuses still presents a challenge, because of failure to make an early diagnosis. Patients are often seen only after extension of the lesions into the surrounding bone structure. Valencia and Rosenthal[71] have accomplished eradication of epidermoid carcinoma in 2 of 3 cases reported, 1 patient surviving for three years and four months and the other for four years and two months.

Miscellaneous Conditions

Munson and Munson[72] treated 20 patients with acute sinusitis with medium-voltage radiotherapy. Eleven patients had immediate relief after one treatment, and 4 after three treatments; 3 required five or six treatments. The authors conclude that small doses (100 to 150 r per treatment) give relief of pain in a large percentage of patients.

Roentgenotherapy in the atrophic arthritides relieves pain, spasm and stiffness according to Kuhns and Morrison.[73] Kersley,[74] writing of arthritis and rheumatism, asserts that probably no group of disease susceptible to x-radiation has been more neglected by the radiotherapist. Hemphill and Reeves[75] show that the best results in Marie-Strümpell disease can be expected if x-ray therapy is begun while there is still active granulation and before ankylosis has set in. They obtain reduction of pain and stiffness, gain in weight, decrease in sedimentation rate and a return to gainful occupation in a large proportion of patients.

Rapid and dramatic relief of the agonizing pain of acute bursitis has been demonstrated by Brewer and Zink,[76] who advocate a single large dose of 300 r with 200 kilovolt therapy. Others[77, 78] recommend smaller multiple doses. Only fair results have

been obtained with the chronic bursitides, however, with relief reported in 30 to 40 per cent of cases.[76–78]

Robbins[79] demonstrated no ill effects and fairly long remission with multiple small doses to large areas of the body in the treatment of polycythemia vera. Hall et al.[80] report their results with radioactive phosphorus in this disease. They observed remissions lasting from nine to twenty-six months. An excellent review of treatment results with radioactive phosphorus is presented by Reinhard and his co-workers.[46] The only encouraging results were found in the treatment of polycythemia vera. Other blood dyscrasias and lymphomas were more difficult to control than by roentgenotherapy.

In the treatment of acute infections, Kelly[81] points out that fairly large areas should be irradiated, including some normal tissue around the infection. He also notes that the sulfonamides alter or inhibit the effect of x-rays and points out that the two types of therapy should not be combined, since the combination of the therapeutic agents produces a high morbidity.

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CASE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL

Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

TRACY B. MALLORY, M.D., *Editor*

BENJAMIN CASTLEMAN, M.D., *Associate Editor*

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CASE 34021

PRESENTATION OF CASE

A seventy-eight-year-old housewife entered the hospital with the chief complaint of difficulty in swallowing.

During the two years preceding admission the patient was bothered by a chronic nonproductive cough that went through cycles of exacerbation and remission. She denied hemoptysis and night sweats. About a year before admission she was put on a diet for hypertension and lost 20 pounds in five or six months. Following this, however, she continued to lose another 20 pounds, and lost her appetite. About three months before admission she became hoarse, the cough became coarse, and she noted weakness and fatigue. She had no difficulty in swallowing solid food, but liquids regurgitated into the nose. She denied nausea, vomiting, indigestion, abdominal pain or any abnormality of bowel habit.

Ten years before admission the patient had had a radical mastectomy for carcinoma simplex, with a metastasis to one of ten regional lymph nodes examined. Six years before admission a lymph node had been excised from the submaxillary region, and a diagnosis of malignant lymphoma, follicular type, was made. The patient had had known high blood pressure for many years and moderate dyspnea and orthopnea for several years. There was no edema of the ankles and no episodes of congestive failure.

Physical examination revealed a pale, obese, flabby, deaf woman in slight respiratory distress. The right breast was absent, and the operative wound was well healed, without evidence of recurrence. No lymph nodes were palpable in the neck or in the axillas. The chest was clear. The heart was questionably enlarged, with a Grade I apical diastolic murmur. The abdomen was soft; no organs or masses were palpable.

The temperature, pulse and respiratory rates were normal. The blood pressure was 220 systolic, 110 diastolic.

Examination of the blood disclosed a red-cell count of 4,300,000 with a hemoglobin of 14 gm., and a white-cell count of 7200, with 64 per cent neutrophils, 34 per cent large lymphocytes and 2 per cent monocytes. The nonprotein nitrogen, the total protein and the blood chloride were within normal limits. An electrocardiogram showed right bundle-branch block. An x-ray film of the chest revealed no abnormal shadows in the lungs, ribs or pleura. There was a streak of atelectasis in the right costophrenic angle. With the aid of a barium swallow a pressure defect was demonstrated in the esophagus, pushing it forward as well as narrowing the lumen. This was at the left of the aortic arch. A similar defect was demonstrated on the anterior margin just below the carina (Fig. 1).

On the fourth hospital day esophagoscopy was performed. An area of narrowing was found, but it was possible to pass the instrument beyond the point of obstruction and careful inspection showed no lesion of the mucosa.

X-ray therapy was begun, at first 200 and then 300 r to the mediastinum daily, followed by alternating anterior and posterior portals.

The patient did not do well. Cough, dyspnea and dysphagia continued. On the second day after esophagoscopy the temperature spiked to 101°F., and a chest film showed a markedly elevated right leaf of the diaphragm and several streaks of atelectasis about the dome. On the twenty-first hospital day a gastrostomy was done, but the patient was not benefited appreciably. The temperature from

the third postoperative day on was elevated, going as high as 102.5°F., and the operative wound broke down around the gastrostomy tube. The patient gradually lapsed into coma and died quietly on the eighth postoperative day. The chest had remained clear until the very end.

Differential Diagnosis

Dr. Carroll C. Miller: We have two lines of attack in making the diagnosis in a case of this sort. The first is anatomic, to determine whether the mass that evidently accounts for the difficulty in swallowing was intraluminal, extraluminal or extrinsic to the esophagus. The other line concerns the relative probability of the three suggested pathological diagnoses — carcinoma of the esophagus, which, particularly in this age group, is most common, or metastasis from one of the malignant tumors already demonstrated, lymphoma or carcinoma of the breast.

May I see the x-ray films?

Dr. Stanley M. Wyman: The heart is prominent toward the left in the region of the left ventricle. The aortic arch is obviously tortuous, and there is tortuosity in the descending aorta, where it can be faintly seen behind the heart. There is a streak of atelectasis at the right base. Pressure on the esophagus is demonstrable on the right posterior aspect just below the level of the arch of the aorta in these two films and also on the spot film. A second area of pressure on the esophagus is seen lower down anteriorly on the left. These areas show no evidence of intrinsic involvement of the esophagus and appear to be pressing upon rather than arising in the esophagus.

Dr. Miller: I assume that there is no fluoroscopic report to demonstrate motion of the right leaf of the diaphragm. The patient was perhaps too ill at this point to be fluoroscoped.

Dr. Wyman: I believe that the patient was fluoroscoped, because of the spot films, but I do not know what the fluoroscopist said about the diaphragm.

Dr. Miller: To go back to the first category, I think that we can dismiss an intraluminal growth as a cause of the obstruction. Two methods of examination are in agreement on this point: the swallow of barium revealed a clearly outlined mucosal pattern of the esophagus, and esophagoscopy showed no evidence of mucosal destruction.

So far as an intramural growth is concerned, we usually see a more definite bulging, a distortion of the mucosal pattern, and with it a mass of solid consistence outside the esophagus. But, again, it is not always definitely possible to see an intramural mass by x-ray examination.

Concerning the third group, the extrinsic masses, we can get only such information as the x-ray examination provided us with here. Usually, however, there are other data that help in making such a decision, especially the presence of mediastinal lymph nodes. Dr. Wyman did not mention the presence of mediastinal nodes in these films. I do not see them, and I do not believe they are there.

Dr. Wyman: I cannot identify them per se, unless the esophageal pressure defects are from enlarged lymph nodes.

Dr. Miller: Before we discuss the more likely possibility one should mention other extrinsic causes for compression of the esophagus. The two more common ones are aneurysm and a benign

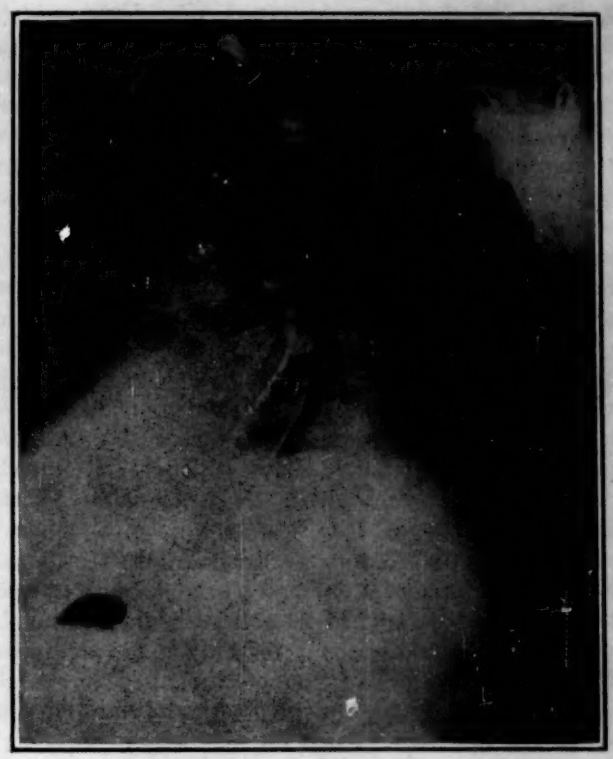

Figure 1.

nontumorous obstruction from enlarged lymph nodes. I am thinking particularly of tuberculosis. We have had several cases of tuberculosis in this hospital with esophageal obstruction because of tuberculous involvement of mediastinal lymph nodes. I do not believe that this patient had an aneurysm; the x-ray studies do not show evidence of it. The symptom of hoarseness immediately makes one think of involvement of the recurrent laryngeal nerve, which is frequently seen with aneurysm. We do not know which nerve was involved. There was no mention of which cord was paralyzed. Because of the high diaphragm that subsequently developed I should guess that the right phrenic nerve became involved, and consequently paralysis of the right recurrent laryngeal nerve is more probable. I see no evidence of aneurysm of the right

subclavian artery or great vessels at the base of the heart.

We have no further evidence of tuberculosis, although this is not necessarily required in making such a diagnosis. Cases of tuberculous adenitis may not have demonstrable evidence of tuberculosis in the chest or elsewhere. Having dismissed the most common causes of extrinsic pressure and having dismissed the diagnosis of epidermoid carcinoma of the esophagus, I might also dismiss adenocarcinoma of the esophagus because it is relatively rare to find adenoid tissue in the esophagus — at this level, particularly — not visible at esophagoscopy.

We can thus continue to a discussion of the likelihood of lymphoma or metastatic carcinoma, which brings us down to a more or less statistical discussion. The patient had had carcinoma of the breast ten years previously. Although the survival of patients with metastases from carcinoma of the breast is definitely short, in the region of 30 per cent five-year cures, we have been seeing what I would call a considerable number of late cases of metastatic carcinoma from the breast anywhere from six to twelve years postoperatively. These patients have no symptoms whatsoever of metastatic disease. In reference to the exact symptoms that this patient had, we find a common one, frequently the first that bothers the patient with this disease — namely, cough. For two years she had had nonproductive cough, evidently a general irritative phenomenon around either the trachea or major bronchi. The x-ray studies in this hospital showed no evidence of pulmonary disease in this patient. We must assume that she had a more local irritative factor. These patients who first begin to cough years after a radical mastectomy for carcinoma have a nonproductive cough, and they have increasing dyspnea as the mediastinal lymph nodes encroach more and more on the major bronchial system. Subsequently, they have collapse of various parts of the lung because of unsatisfactory drainage from the bronchial tree. So much for carcinoma. Another red herring is the presence of malignant lymphoma in this history — one solitary focus removed six years previously from the submaxillary gland. Do we know if she ever had evidence of recurrence of this tumor?

DR. TRACY B. MALLORY: The patient was followed at relatively frequent intervals at the Huntington Clinic, and no evidence of recurrent disease was found.

DR. MILLER: It is said that malignant lymphoma may remain quiescent for many years. One author quotes the average duration of life with malignant lymphoma of the follicular type as four years, but various others list it as six to fourteen years. The diversity of lymphomatous involvement in the body is well known, and there may be such disease in the mediastinal nodes to account for this difficulty.

I believe that I must make a diagnosis of metastatic carcinoma of the breast. The patient had progressive weight loss. This is frequently found in the absence of symptoms or definite physical demonstration of metastatic disease. She had an invasive type of tumor. I say that because she must have had nerve palsy of both the recurrent laryngeal nerve and the phrenic nerve. She had progressive disturbance of the esophagus and the bronchial system, with increasing dysphagia and increasing tracheobronchial irritation. The difficulty in swallowing liquids, with no difficulty in swallowing solid food, is also suggestive of nerve injury.

DR. MALLORY: Would anyone care to consider the possibility of primary bronchiogenic carcinoma?

DR. DONALD S. KING: I do not see how it could be ruled out.

DR. MILLER: Certainly the sequence of events is compatible with that diagnosis. Multiple malignant tumors in the same patient are being more and more frequently seen. This patient would then have had three different tumors.

CLINICAL DIAGNOSIS

Metastatic carcinoma of mediastinal lymph nodes.

DR. MILLER'S DIAGNOSIS

Metastatic carcinoma from breast to mediastinal lymph nodes, involving esophagus and right main bronchus.

ANATOMICAL DIAGNOSES

(Carcinoma of breast.)

Metastases to mediastinal lymph nodes involving esophagus and right main bronchus.

Metastases to liver.

PATHOLOGICAL DISCUSSION

DR. MALLORY: The section from the submaxillary region on which the diagnosis of giant follicular lymphoma was made a few years ago was shown to me before I knew the history and the outcome of this case, and I disagreed with the diagnosis, reporting it as inflammatory hyperplasia. At autopsy we found a very scirrhous tumor occupying the region of the mediastinal lymph nodes, which were largely unrecognizable. The tumor had extended posteriorly into the wall of the esophagus and anteriorly into the wall of the right bronchus. There was extensive involvement of the bronchial mucosa. Therefore, from the gross evidence it could have been primary bronchiogenic carcinoma. We believed that we could rule out a primary tumor of the esophagus.

Microscopical sections showed a scirrhous adenocarcinoma, and though not absolutely conclusive were much more suggestive of a metastatic lesion from the breast than of a primary bronchial tumor. Part of the swallowing difficulty was due to a retropleural abscess above the point of tumor involvement of the esophagus. There were some

metastatic nodules in the liver. There was no evidence of lymphoma at autopsy.

DR. MILLER: What do you suppose the duration of the abscess was?

DR. MALLORY: A number of days or perhaps a couple of weeks — a very acute lesion, I believe.

CASE 34022

PRESENTATION OF CASE

A fifty-one-year-old Italian electrical worker was admitted to the hospital because of hemoptysis.

Two years previously, he had an upper respiratory illness characterized by cough, sweating and pain in the right lower portion of the chest on breathing. He had not worked for several weeks, but did not remain in bed. Recovery from this episode was apparently complete, but eight months later a similar episode occurred. At that time the cough was productive of considerable whitish sputum. A bronchoscopy was performed, but no diagnosis was given to the patient. Three months before entry he again began to feel "bad all over." The cough returned, persisting throughout the day, and was productive of a small amount of blood-tinged sputum, which was raised mainly in the mornings. He had been anorexic, with a weight loss of 7 pounds, and had been unable to work for three months.

Physical examination revealed that the lower third of the right portion of the chest posteriorly was dull to percussion, with diminished breath sounds heard over the area. The prostate was regular, firm and enlarged to twice the normal size.

The temperature, pulse and respirations were normal. The blood pressure was 125 systolic, 80 diastolic.

Examination of the blood disclosed a hemoglobin of 14.6 gm. and a white-cell count of 10,600, with 71 per cent neutrophils; urinalysis was negative. A blood Hinton test was negative. Five sputum examinations and one guinea-pig inoculation were negative for tuberculosis.

An x-ray film of the chest showed a segmental area of atelectasis posteromedially in the right lower lobe. The adjacent portions of the lower lobe close to the abnormal area were somewhat emphysematous. There were small blebs in both apices. The heart was displaced slightly to the right. A bronchogram revealed incomplete visualization of the right middle-lobe bronchus, and the middle lobe appeared slightly diminished in size. The bronchi to the anterior basal segment and dorsal division of the right lower lobe appeared normal; the bronchi leading to the atelectatic area were not filled. Laryngoscopy and bronchoscopy disclosed considerable thick yellowish-green secretion in the larynx and trachea. The right bronchial tree was reddened throughout and contained thick yellowish-green secretion. The right upper-lobe orifice was reddened, and the bronchus displaced downward. The stem bronchus and the middle-lobe orifice were also reddened. The lower-lobe bronchus was red, edematous and displaced to the right, with considerable thick secretion and edema. No adenoma or foreign body was visible. The remainder of the examination was negative.

On the fourteenth hospital day an operation was performed.

DIFFERENTIAL DIAGNOSIS

DR. LAMAR SOUTTER: The general picture is that of a middle-aged electrical worker with a brief history of pulmonary disease — that is, brief compared to many stories of chronic pulmonary infection that we see. There were three episodes of illness: one, two years before entry, one fourteen months before entry, and finally a third. The first two illnesses were not of very long duration, and recovery was apparently quite complete. They seemed to be infectious in nature. I do not receive the impression of a patient with steadily progressive disease, such as might be expected with tumor, but rather a picture of two attacks of pneumonitis with sputum, and probably an elevated temperature, although that is not stated. He did have pain in the right lower portion of the chest, and hemoptysis, on one occasion. The third sickness was of much longer and more serious extent. The patient when he came in had been unable to work for three months. On arrival at the hospital he gave the appearance of having chronic pulmonary infection. He did not have a high temperature, although he had a slight elevation of the white-cell count. He was raising sputum, and he had morning sweats, malaise, anorexia and weight loss.

What would be the source of a chronic infection in a man of this age coming into the hospital with this brief history? In looking back on the first two episodes, the possibility of septic infarction arises, followed by abscess formation, the abscess healing but perhaps breaking down and healing and breaking down again. On the other hand one wonders about that when presented with the x-ray picture showing an area of increased density without the fluid level that one might expect in an abscess of some two years' standing, which had been active for at least three months prior to entry. We do have the idea, however, that although an abscess was unlikely there was probably some bronchial obstruction because atelectasis was observed by x-ray examination.

I wonder if Dr. Wyman will show the x-ray films at this point?

DR. STANLEY M. WYMAN: The only available films are those taken after the introduction of lipiodol. The left anterior oblique view shows best the area of atelectasis, in the posterior medial

segment of the right lower lobe. The bronchi to this region are incompletely filled.

DR. SOUTTER: Does the incomplete filling suggest difficulty in injecting the dye or an obstruction of the bronchi?

DR. WYMAN: There is some obstruction of the flow of lipiodol to that region. I can see no definitely abnormal bronchi on the right side. The left side appears perfectly normal.

DR. SOUTTER: The information that is given to us by the x-ray pictures is one of atelectasis with possible partial obstruction to the bronchus leading to the atelectatic area. It is probably right to assume that the chronic infection had its origin in this collapsed area. What should we regard as the etiology of this collapse? Obstruction, partial or complete, in a bronchus can come from extrinsic pressure, from cicatricial narrowing of the bronchus secondary to infection or from obstruction inside the bronchus by a mucous plug, by a foreign body, by an adenoma or by a carcinoma.

What information do we get from bronchoscopy? It confirmed the evidence of infection in the right side of the lung. The sputum was described as thick and greenish; it was not described as foul. We can assume that the aspirated secretion came from the right lower lobe by the description of edema in this bronchus. The reddening elsewhere reflects the severity of the infection rather than an extension of the disease process.

DR. EDWARD B. BENEDICT: In the bronchoscopic report I mentioned that the breath was very foul.

DR. SOUTTER: There is some evidence, then, of a possible putrid abscess, since the breath was foul, and that is something that we should consider.

What about infection causing obstruction of the bronchus? The x-ray picture is not one of a true bronchiectasis due to a mixed infection. We do not have a report of the sputum culture. We cannot tell, of course, whether the lipiodol failed to enter the bronchus or whether there was some bronchiectatic obstruction. This is not the typical picture of long-standing pulmonary infection or the characteristic story of bronchiectasis that goes back to childhood. If present from childhood the disease is usually manifested at an earlier age. So we may assume that whatever caused the trouble was probably more recent, and that bronchiectasis on the basis of chronic infection is probably not a great likelihood in this case.

What about bronchiectasis on the basis of tuberculosis? Has that been completely eliminated by the sputum studies or the location of the atelectasis? I do not believe that it has been completely eliminated. With the report of thick, greenish, foul sputum, which was negative on bacteriologic study, however, it is probably not very likely.

We should consider actinomycosis, blastomycosis or some fungous infection. The position is right for abscess formation due to these types of organisms. These abscesses are usually in the lower lobes when they occur. On the other hand, the causative organisms are generally readily identifiable by sputum examination. In actinomycosis the sulfur granules are often coughed up. We have seen an occasional case in which these organisms did not appear in the sputum, and not until after the lung tissue had been removed was it obvious that actinomycotic abscess was the correct diagnosis.

What about the possibility of a foreign body plugging the bronchus? That is not likely in an adult without a history of aspirating some object. In a child such a diagnosis could be seriously considered without such a history, but not in an adult. Furthermore, we might see a radiopaque foreign body by x-ray study.

That brings us, then, to the consideration of whether or not this could have been a tumor of some sort. We think first of course of an adenoma — or, in other words, a benign tumor arising in a bronchus. Most adenomas arise in the main bronchus on one side or in a branch of it. Very seldom do they occur so far peripherally as not to be readily observed by bronchoscopy. They usually occur in people younger than this man. The patient nearly always gives a history of chronic infection or hemoptysis before coming into the hospital.

Could this have been a metastatic carcinoma? A metastatic carcinoma usually appears as a round shadow in the lung periphery. It will not cause collapse of a lung segment until it has grown large enough to press on a bronchus. The only organ suggested by the story as a source of a primary tumor was the prostate. Although the prostate was enlarged to twice the normal size, it was smooth and not nodular. Furthermore, the history was not that of metastatic disease.

Other diseases such as sarcoid and lymphoma should be mentioned. They seem unlikely because in those diseases the lesions are usually multiple and give a different x-ray appearance, atelectasis being more apt to occur very late as they progress.

Therefore we come down to bronchiogenic carcinoma. Adenocarcinoma is less common than the epidermoid type. What is the possibility of an epidermoid carcinoma with partial or complete bronchial obstruction, dilatation of the bronchus distal to this with abscesses and a great deal of inflammation? I think that the chances are very good. The patient was in the right age group for cancer although younger than many patients with bronchiogenic carcinoma whom we see. This tumor does not always occur at the hilus. It can occur in bronchial tissue far out in the periphery of the lung. It is nearly always attended by atelectasis — so much so that I feel strongly that atelectasis in a patient in this age group, without evidence of other causative disease, should be regarded as secondary to bronchiogenic carcinoma. What about the emphysematous blebs and the bloody sputum?

I do not believe that the blebs were of any importance in this man. Blood-tinged sputum can occur in a great number of diseases and is not of much help diagnostically.

I shall hazard a diagnosis of carcinoma of the bronchus leading to the collapsed area of the lung and atelectasis, with chronic infection and perhaps small abscesses in that segment of the lung.

Dr. Donald S. King: I cannot remember any case with cancer in a bronchus with a negative bronchoscopy, can you, Dr. Benedict?

Dr. Benedict: No, I cannot; and my impression was that the bronchoscopy was definitely consistent with bronchiectasis — that is, a hemorrhagic bronchiectasis with a red, edematous mucosa that we frequently see in straight bronchiectasis causing enough bronchial obstruction to give this picture.

Dr. King: That would be my bet. I was trying to think whether this was one of Dr. Sweet's pneumonitis cases and whether one would find cholesterol. I would bet that it was not that type of disease, but an area of bronchiectasis with abscess, which usually does not give so much cholesterol as these so-called pneumonitis cases. We have not a plain x-ray film to see if the abscess looked as much like tumor as those in Dr. Sweet's cases did.

Dr. John G. Scannell: This man had had a previous bronchogram six to eight months prior to entry here that showed diffuse bronchiectasis of the right lower lobe and also questionable involvement of the right middle lobe. We repeated this for our own information partially, and our feeling was that he had bronchiectasis in the major portion of the lower lobe. It improved for a period as judged by x-ray study, but we were puzzled by the segmental nature of the process. We debated whether or not to let the patient go home and get the bronchus in better shape and come back for a surgical procedure. In view of the segmental nature, Dr. Churchill thought that we should proceed with operation. With the data we had and with a man in this age group a lobectomy was done (Fig. 1). The pleura as I remember it was involved. The lobectomy was carried out without undue difficulty. The gross appearance of the lung was that of recurrent infection. The lower lobe showed the gross appearance of bronchiectasis. We did not open the bronchi at operation.

Clinical Diagnosis

Bronchiectasis, right lower lobe.

Dr. Soutter's Diagnoses

Epidermoid carcinoma of branch of right lower-lobe bronchus.

Secondary atelectasis and infection.

Anatomical Diagnoses

Epidermoid carcinoma of bronchus of right lower lobe.

Bronchiectasis.

Pneumonitis, chronic.

Pathological Discussion

Dr. Tracy B. Mallory: When the lung was sectioned in the laboratory we found the bronchi-

Figure 1.

ectasis, but it was obvious that there was also slight but definite nodularity of the mucous membrane of the bronchus. Sections from that area showed an epidermoid carcinoma. The surrounding lung tissue showed chronic pneumonitis of the secondary suppurative type seen with bronchiectasis.

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EARLY DIAGNOSIS OF CANCER

MUCH has been said in recent years of the value of early diagnosis in the prevention of deaths from cancer. A good deal of the burden of such early diagnosis is placed on the patient, who is asked to present himself to the physician as soon as he has any of the cardinal signs or symptoms that may result from neoplastic disease. Of equal and possibly even greater importance is the physician's examination of the patient, irrespective of the presenting complaints or apprehensions. Studies for the presence of cancer cells in stained smears of swabbing, scrapings, secretions or excreta are becoming increasingly vital for this purpose.

Fremont-Smith, Graham and Meigs[1] have recently presented reports of 12 cases of early cervical cancer in which vaginal smears were positive for tumor cells in 10. Two patients had no symptoms referable to the lesion. In this small group of cases the simple procedure of vaginal smears was more conclusive than the conventional biopsies; in 9 cases in which such biopsies were performed, a diagnosis was made in the initial specimen in only 3. The authors pointed out that preinvasion cancer may exist for several years before evidence of the disease appears. When a carcinomatous lesion of the cervix manifests itself by symptoms, it is often no longer in the early stage. Since early diagnosis is essential if cancer of the cervix is to be cured, the study of vaginal smears for cancer cells is of the greatest importance.

Similar studies of stained smears of sputum or bronchial secretions may be of help in the diagnosis of bronchogenic carcinoma. Some workers have succeeded in demonstrating tumor cells in suitably prepared smears in 64 to 94 per cent of proved cases of cancer of the lung.[2-5] False-positive reactions are quite infrequent.

Papanicolaou,[6] who has been responsible for many improvements in the technics of demonstrating tumor cells in stained smears, has also developed improved methods for identifying malignant cells in urinary sediments. This has made possible the detection of malignant processes in the urinary tract in some cases without recourse to the usual, more laborious procedures of pyelography, exploration and biopsy. Considerable success has recently been reported from the Mayo Clinic,[7, 8] although these methods have not proved infallible. Considerable success had also been attained in the diagnosis of cancer of the prostate from examinations of prostatic secretions with the Papanicolaou technic. The diagnosis in such cases is said to be simpler than that in bronchogenic neoplasms or in genital cancers in women because the secretions from the noncancerous prostate contain very few epithelial cells whereas bronchial and vaginal secretions normally abound in such cells.[9]

These findings offer a definite challenge in the field of cancer case finding. Frequent examinations of stained smears of various types of secretions and improvements in technics and interpretations may yield significant results, which, like x-ray surveys

for the detection of tuberculosis, may well turn out to be of the greatest value as a public-health measure in the control of cancer.

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EATING OUT IN SAFETY

An article in the Massachusetts Department of Public Health column in this issue of the *Journal* gives information that makes us wonder why even more illness does not result from the increasing American custom of "eating out," for surveys conducted by the Massachusetts Department of Public Health during the last two years disclose that the sanitary conditions in restaurants and other eating places in the Commonwealth are far from ideal.

Public opinion, apparently, is doing a very satisfactory job of policing the conditions in the front of such establishments, and places that do not provide clean and cheerful surroundings fail to gain patronage. Unfortunately, the public usually knows very little of what is going on behind the scenes, where the danger usually lurks, and in communities where there are no regular inspections by health-department personnel slipshod methods quickly develop.

The public, however, has the right to expect that health agencies will take the responsibility for seeing that what happens behind the scenes is not endangering health; on the other hand, the health agency can expect the community to provide sufficient well trained personnel so that this responsibility can be satisfactorily met. In many municipalities the remuneration available for health-department employees is not sufficient to obtain the services of an inspector who knows enough about restaurant sanitation to do a satisfactory inspection job. The Massachusetts Department of Public Health with its small staff of sanitarians can only attempt to assist local inspectors in learning to make satisfactory inspections so that owners of eating places may be informed of what is expected of them.

It is not surprising that some of the conditions exist because even owners have had little opportunity to learn the importance of many of the procedures usually demanded in restaurant sanitation regulations. Owners are usually co-operative in improving conditions when the faults are called to their attention.

Physicians, as important citizens of the community, can exert a forceful influence on this particular problem if they will inform themselves regarding conditions in their own communities and speak a word to the proper public officials.

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

RESTAURANT SANITATION

Hardly a week goes by in Massachusetts that we do not hear of an outbreak of disease following a church, school or lodge banquet, or a meal served at some large cafeteria or a restaurant. Unfortunately, most of the outbreaks due to contaminated food in restaurants are never officially reported. That such outbreaks do originate in restaurants is evidenced by the fact that various members of the Department hear about them, sometimes weeks or even months after they occur.

Most outbreaks could be prevented if three important items of sanitation were strictly observed: if persons handling food took more interest in personal hygiene, and particularly if they kept their hands clean; if all foods favorable to the growth of bacteria were properly refrigerated; and if multi-use utensils employed in the preparation or serving of food and drink were thoroughly cleaned and effectively sanitized immediately after the day's operation, or more frequently if necessary.

Other items of sanitation such as cleaning and bactericidal treatment of eating and drinking facilities, structural facilities and waste disposal are important, but the experience in Massachusetts is that the three items mentioned above are the most important ones.

The Department of Public Health, through the Division of Food and Drugs, has authority to in-

spect restaurants and other eating establishments and to order correction of violations of items of sanitation. However, this division does not have a sufficient number of inspectors to put in operation even a routine inspectional program. Some local health departments are carrying on reasonably effective restaurant inspectional programs; in other places no inspections are made, or so few that the program is not effective.

Through the Bureau of Sanitation in the Division of Local Health Administration, an educational program is being conducted. At the request of the local board of health, restaurant sanitation surveys are made. The purpose of these surveys is to evaluate the program being carried on by the local health department and to make recommendations for its expansion and improvement.

With the Department's recommended regulations and interpretations as a guide, inspections are then made — generally of all eating and drinking establishments, — although occasionally, in larger communities, only a limited number of establishments chosen at random can be inspected. A rating is given to each, and a rating is also given to the community.

The ratings for individual communities during the past fiscal year ranged from 35 to 89 per cent. The Department believes that the requirements of its recommended regulations represent minimum standards for the protection of the public and that ratings of 90 per cent or more indicate a reasonably strict enforcement of regulations.

Of approximately a hundred Massachusetts communities surveyed during the past two years, none have received ratings of 90 per cent, and only nine received ratings of over 80 per cent. Only about twenty rated over 70 per cent. There is obviously much to be done before restaurant sanitation programs in Massachusetts can be considered satisfactory. However, a study of inspection reports indicates that the ratings of at least 50 per cent of the restaurants in the Commonwealth, with some effort on the part of owners and employees, and at comparatively little expense, could be raised to 90 per cent or over.

The Department believes that the influence of the medical profession, properly applied, can be of inestimable help in this program, particularly in making appropriating bodies see the necessity of providing sufficient funds. Letters from the physicians of a community to the mayor or board of aldermen would be of great value. In communities where ineffective programs are being carried on, the medical society should take the lead in formulating public opinion, to which public officials must of necessity be susceptible.

Physicians are further urged to report cases of food-borne diseases coming to their attention.

IMMUNIZATION AGAINST PNEUMOCOCCAL PNEUMONIA

A large percentage of cases of lobar pneumonia are caused by the 75 varieties of pneumococci. The fact that there are so many varieties has made the problem of immunization a complicated one, and up to the present time no general immunization programs have been feasible.

All the efforts against pneumonia have necessarily been directed toward saving lives. Pneumonia serum for some types has been available in Massachusetts since 1917. By 1931 a special effort to spread the use of serum was begun by the Department; by 1936 the use of serum was rapidly increasing; and in 1939, when serum for many types had become available, the use reached its peak.

At that time the use of the sulfonamides began to displace other means of treatment, and by 1944 penicillin was available in sufficient quantity to exert an influence upon the pneumonia death rate. The sequence of events can be noted in the following analysis of cases and deaths from lobar pneumonia in Massachusetts:

Year	No. of Cases*	No. of Deaths	Year	No. of Cases*	No. of Deaths
1935	4370	1731	1941	3617	860
1936	5459*	1944†	1942	3290	749
1937	5322	1846	1943	3104	967
1938	4296	1312	1944	3059	764§
1939	4460	1211‡	1945	2137	622
1940	4332	925	1946	1483	592

*Some of the cases made milder by drugs were probably not reported by physicians in later years.

†Use of pneumonia serum increasing rapidly.

‡Wide use of sulfonamides begins.

§Penicillin becomes easily available.

The deaths from lobar pneumonia cannot be expected to fall much lower because of treatment with the new drugs. If the disease is to be reduced in importance, some method of immunization is needed.

In 1924 it was found that capsular material of the pneumococcus, called "polysaccharides," formed the basis for virulence and type specificity among such encapsulated bacteria. In 1927 and 1930 immunization of mice with these polysaccharides was first attempted, and in the latter year it was demonstrated that an antibody response could be obtained in man by the injection of these purified substances. This meant that an extract of the capsular material surrounding the pneumococcus, when injected into man, could produce protective antibodies capable of creating immunity to infection by the organism. Because of the difficulty and high cost involved in isolating these polysaccharides, only limited quantities could be produced until recently, when new methods for preparation were devised.

As mentioned above, at least 75 different types of pneumococci have been isolated to date. Each produces its own specific type of polysaccharide. It has been found that 11 of these 75 types are responsible for more than 60 per cent of all lobar pneumonias. Furthermore, 6 of these 11 types are most

commonly found in adults (Types 1, 2, 3, 5, 7 and 8), whereas the 5 other types in addition to one from the adult group (Types 1, 5, 6, 14, 18 and 19) are found chiefly in children. Therefore, two "vaccines" have been prepared combining the pneumococcal types most frequently causing lobar pneumonia in adults and in children respectively.

In the fall and winter of 1944–1945 at an Army Air Force Technical School, where there had been a high incidence of lobar pneumonia for the preceding two winters, 8586 men were injected with appropriate vaccine, and 8449 were not. After a six-month observation period, it was found that only 4 cases occurred among the immunized and 26 cases among the unimmunized men. Antibodies appeared in the blood, on the average, nine days after injection, and the minimum limit of protection was estimated as being one year.

Similar results were obtained in a six-year study on elderly people immunized with polysaccharides. In this study 3 per cent of the immunized subjects came down with the type of pneumonia inoculated against as compared to the control group, whose incidence was 14.5 per cent. The incidence of other types, against which neither group was immunized, was approximately the same in both groups.

It appears that immunization should be valuable for the elderly and the very young, who are especially susceptible; for special occupational groups, in whom the incidence of and death from pneumonia is unusually high; for persons in institutions, where pneumonia frequently occurs in epidemic form; and for patients about to undergo surgical procedures or recovering from a severe protracted illness.

Unfortunately, the "vaccine" offers protection only against the types of pneumococci contained therein and not against any other of the numerous types.

NATIONAL CONFERENCE ON LOCAL HEALTH UNITS

Under the auspices of the American Public Health Association, a national conference on local health units was held at Princeton University on September 9 and 10, 1947. A hundred delegates of sixty-five national citizen and health agencies were called together to launch a campaign of popular interest and support in behalf of providing at least the minimum of local health services now denied to a third of the population of the United States.

The essential facts brought out in these meetings may be summarized as follows:

A local health department should do at least the following for its community: record the facts of births, deaths, sickness and make the data available for use in planning community health programs, school services, industrial health services and hospital and medical-care facilities; carry out all necessary activities to control communicable and preventable diseases, such as tuberculosis, venereal diseases, malaria and hookworm infection, and the communicable diseases of childhood; supervise the health of the mother and the child from birth through school years, finding the remediable defects of eyes, ears, teeth, nutrition and posture and providing for their correction either directly or through existing community facilities; supervise the physical surroundings of the community and co-ordinate the necessary activities for making it favorable to health and well-being (this means providing for clean water, milk and food, for healthful housing, working conditions, proper sewage disposal and sanitary recreation facilities); provide public-health laboratory service both to carry out its own job and to assist practicing doctors of the community in diagnosis and treatment; and carry on public-health education, making known to the people generally the facts of modern biology and science and giving instruction in the use of such facts to keep in good physical health.

To provide the services of a local health department its staff must include at least a full-time medical officer; one nurse per 5000 population; two or more workers in environmental sanitation per 50,000 population, the director being a public-health engineer; one clerk per 15,000 population; physicians and dentists to give service in clinics, perhaps on a part-time basis; and laboratory workers, health educators, dental hygienists and other workers as local conditions demand and local resources permit.

A third of the population of the United States, particularly in rural areas, is without even an organized local health department directed by a full-time health officer and probably more than two thirds are without even the minimum staff suggested above.

Currently, 20,000 of 38,000 different local governmental jurisdictions (towns, villages, parishes, townships, counties and cities) and 70,000 of 108,000 school districts are attempting to operate their own health services.

Such small units of government can never hope to have enough tax money or to attract the necessary trained workers to carry out the six minimum functions outlined above. Therefore, the following principles are suggested by the report of the American Public Health Association: no unit of local government below a county should attempt to organize its own health service; no population unit of much below 50,000 can support a local full-time health service; both the county and its contained cities should join together in organizing a single local health depart-

ment (this has several advantages — it helps to make a large enough population unit to make a department economically possible and efficient and tends to equalize the differences in wealth between urban and rural areas, and the city, which depends upon its surrounding rural areas for much of its wealth and trade, should thus also be prepared to co-operate in providing basic health services required in common by all the people of the composite community); and in counties with less than 50,000 population, two or more that form a natural trade and transportation area should pool their resources to form a district health unit with at least this minimum population — more adequate services for the same amount of per capita expenditures can be achieved with an even larger population than the minimum, such as 100,000 or more, if no part of the population of the area is more than forty miles from the central point at which the health department would be located.

The following seven steps are necessary to build a community temple of health: the state health department should have a workable plan whereby local health service can be carried out for every community in the state; a state-wide citizens' health committee that includes representatives of voluntary and citizen agencies and that is approved by the governor should be organized; if it does not already exist there should be clear-cut legislation providing for county, city-county or district boards of health; the legislation should include authorization for personnel and salaries; the legislation should also include specific authorization for tax support of the local health department, and there should be agreement among state and local authorities concerning local, state and federal sources of tax support; a program of recruiting and training personnel, including in-service training, must be carried out; and a local community council must follow through to obtain local tax support and to keep the department alert, once it is organized.

LOCATION OF TUMOR DIAGNOSTIC SERVICE

As announced in an earlier issue of the *Journal*, the Diagnostic Laboratory of the Massachusetts Department of Public Health is now located at 281 South Street, Jamaica Plain, with the Wassermann Laboratory (JA 4–1232) on the first floor and the Bacteriological Laboratory (JA 4–5440) on the second floor.

Misunderstandings, however, have apparently occurred regarding the location of the Tumor Diagnostic Service. This service is still located at the Harvard Medical School, 25 Shattuck Street, Boston (LO 6–2380). The outfits for shipping specimens, however, are still to be ordered from the Diagnostic Laboratory, 281 South Street, Jamaica Plain.

MISCELLANY

BORDEN AWARD

The American Academy of Pediatrics recently announced that the Borden Award for "outstanding research in the nutrition of infants and children" has been given to Dr. Grover F. Powers, chairman of the Department of Pediatrics at Yale University School of Medicine. The award, which is administered by seven professional and scientific associations, was established in 1936 to recognize and encourage outstanding research achievements in the food industry and related fields.

Dr. Powers is president of the American Pediatric Society and a former president of the New England Pediatric Society.

AMERICAN HOSPITAL ASSOCIATION

Eighteen institutes for hospital administrative personnel, offering intensive hospital service education in short courses, have been scheduled for 1948 by the American Hospital Association. Designed to provide basic material and information, together with a discussion of current problems, the institutes will feature authoritative faculties and are located so that hospitals in all parts of the country may participate. Further information on the institute schedule will shortly be made available to Association members in a special brochure.

In addition to the following, tentative plans have been made for an institute on pharmacy in May in the East, a November institute on hospital purchasing, also in the East, and a Middle Western institute on nurse anesthetists in December:

Date	Place	City	Subject
January 12–16	Soreno Hotel	St. Petersburg, Florida	Dietetics
January 26–30	Wisconsin Hotel	Milwaukee, Wisconsin	Medical records
February 23–25*	Grady Hotel	Atlanta, Georgia	Personnel
March 1–5	Drake Hotel	Chicago, Illinois	Nursing
March 8–12	Providence Hospital Auditorium	Oakland, California	Nurse anesthetists
April 12–13*	Continental Hotel	Kansas City, Missouri	Dietetics
April 26–30	Drake Hotel	Chicago, Illinois	Housekeeping
April 19–23	Buck Hill Falls Inn	Buck Hill Falls, Pennsylvania	Dietetics
May 17–21	Shirley Savoy Hotel	Denver, Colorado	Purchasing
May 24–28	Knickerbocker Hotel	Chicago, Illinois	Operating engineers
May 31–June 4	Westminster Choir College	Princeton, New Jersey	Public relations
June 8–12	Duke Hospital	Durham, North Carolina	Medical records
July 19–23	Penn Sheraton Hotel	Philadelphia, Pennsylvania	Laundry
July 26–30	Drake Hotel	Chicago, Illinois	Accounting
October 4–8	Hotel New Yorker	New York City	Personnel
November 15–19	Wilton Hotel and Municipal Auditorium	Long Beach, California	Accounting
December 6–8*	Roosevelt Hotel	New Orleans, Louisiana	Public relations
December 6–10	Wardman Park Hotel	Washington, D. C.	Hospital planning

*Short institutes.

THE AMERICAN SOCIETY OF ANESTHESIOLOGISTS, INC.

At the annual meeting of The American Society of Anesthesiologists held in New York City on December 4, 5, and 6, 1947, John Abajian, M.D., of the University of Vermont College of Medicine, Burlington, Vermont, was elected to the Board of Directors of that society.

BOOK REVIEWS

Osteotomy of the Long Bones. By Henry Milch, M.D. 8°, cloth, 294 pp., with 181 illustrations. Springfield, Illinois: Charles C Thomas, 1947. $6.75.

Dr. Milch, after long study and experience, has changed the so-considered simple osteotomy to a surgical procedure of refinement and mathematical exactness. The various types of osteotomy, lineal, tortional, transpositional and angulational, are discussed. He shows how varying lengthening and shortening can be obtained by placing the osteotomy site higher up or lower down upon the shaft of the bone and also by varying the amount of angulation at the osteotomy. This can be figured readily by trigonometric formulas. In the femur the greatest increase in length is accomplished by complete valgus of the femoral neck. For the solution of these complex problems about the head and neck of the femur the author has devised a movable frame to show movement of the pelvis and femur and the length of the weight-bearing line after osteotomy and abduction. This frame he calls an "osteotometer." He discusses the application of osteotomy to ununited fractures of the femoral neck, osteoarthritis and tuberculosis. He should be commended for giving so clear and sensible a discussion of osteotomy. Every orthopedic surgeon will profit from reading this book.

Textbook of the Nervous System: A foundation for clinical neurology. By H. Chandler Elliott, M.A., Ph.D. With an introduction by Wilder Penfield, M.D. 4°, cloth, 384 pp., with 158 illustrations and an atlas. Philadelphia: J. B. Lippincott Company, 1947. $8.00.

This anatomic study of the nervous system incorporates a number of new principles, all of them of distinctive importance. To acquaint the medical student with the complicated anatomy of the whole nervous system, the author has divided the book into two parts. The first, which contains a simple outline, covers about a hundred pages, giving the essentials, and is illustrated with diagrams often printed in two colors; the field covered is that needed by every medical student. In the second part, the anatomy and the more simple function of the nervous system are taken up in more detail, corresponding to the needs of an advanced student or one who is going to practice clinical neurology. With the details of the gross anatomy are many diagrams illustrating the text. These are line drawings, giving an extremely clear concept of structural anatomy, particularly of the brain. They are by far the best diagrams known to the reviewer; accompanying them is a text of equal value. In addition, the author has provided, in the appendixes, a list of the principal terms used in anatomy, making particularly clear those of Latin and Greek derivation. A bibliography adds to the value of the work, and by a system of single and double stars, papers and books of particular importance are emphasized. Furthermore, the book is accompanied by an atlas, showing the actual appearance of the brain as the result of a surgical operation, the major details of the skull and serial sections through the principal areas of the brain. There is an excellent index. The book deserves the highest recommendation. It is finely printed on excellent paper, and both the publisher and the author ought to be congratulated on producing an epoch-making contribution to the medical literature.

Hospital Care in the United States: A study of the function of the general hospital. Its role in the care of all types of illness, and the conduct of activities related to patient service, with recommendations for its extension and integration for more adequate care of the American public. 8°, cloth, 631 pp., with 94 tables and 58 charts. New York: The Commonwealth Fund, 1947. $4.50.

In 1932 the Committee on the Costs of Medical Care presented the first comprehensive study of sickness, health and hospitals in the United States, considered the problem of sickness, treatment and prevention, as well as the extent of availability and use of medical care. The report computed its cost to the patient and income to the physician. It presented the needs of the country in doctors and hospital beds, separating the cost of sickness into hospital and nursing expenses, charges for medicines and professional fees. It clearly established the importance of hospitals in the medical structure.

The report of the Commission on Hospital Care further emphasizes the strategic position of the hospital by devoting its entire 600 pages to a discussion of the function of the general hospital in the care of all types of illness. The study also discusses patient service and makes recommendations for its extension and integration for more adequate care.

The Commission consisted of twenty-two persons, in addition to a study staff of nine members and eight technical advisers, assembled in 1944 by a post-war planning committee appointed by the trustees of the American Hospital Association. It was financed by The Commonwealth Fund, the W. W. Kellogg Foundation and the National Foundation for Infantile Paralysis. Although the work antedated and was separate from the surveys authorized by the Hospital Survey and Construction Act, its activities undoubtedly influenced the Congress and advanced surveys in the states. The report is presented "to the American people as a guide to the future development of hospital care" and as such commends itself to all serious students of medical and hospital problems.

The one hundred and eighty-one conclusions and recommendations presented in the second chapter appear overwhelming until it is realized that this section summarizes the wide variety of subjects covered in detail in the next three hundred pages.

Section III lays a foundation of facts and information dealing with a diversity of subjects including factors that have influenced the growth of hospitals, such as religion and war; the growth of hospitals in the United States; the functions of a general hospital; its relations with public-health departments; and standards of service and financing.

The following sections present new and original data regarding the size and need of hospital facilities, such as population, vital indexes, socioeconomic conditions, geography and transportation; the relation of bed-occupancy rate to size of hospital; the effect of urban or rural surroundings; and, finally, a formula for measuring the need of a community for hospital facilities by means of the ratio of beds to deaths.

It has been found that the public uses two hundred and fifty days of general-hospital care for each death and correlated sickness cared for in a general hospital. On an annual basis, adjustment of this figure gives 0.7 bed for each hospital death (bed-death ratio). This ratio must be adjusted again to allow for a normal occupancy of 75 per cent, or 0.875 beds. The death rate in the nation is 10.6 per 1000. The Commission assumed that half these might properly be expected to occur in hospitals, or 5.3. Consequently, 5 beds was computed as the number of general-hospital and allied special-hospital beds per 1000 population as the ultimate and ideal future need of the nation.

There are many methods of computing hospital-bed needs, but the Commission recommends this as the most reliable, pointing out that it is applicable under varying conditions of urban and rural areas, in districts of both low and high incomes and in other economic or population conditions, and that it expresses accurately the ratio of actual use as well as the anticipated immediate needs and can also be used to foretell future needs. For example, when hospital deaths are 4.0 per 1000, occupied beds are 2.8 per 1000 population. As hospital deaths increase so should the number of beds available be increased up to the assumed maximum of 5 beds per 1000 population.

These three hundred pages are the heart of the report and represent the constructive work of the Commission. The final two hundred pages present the best history of hospital development in the United States yet compiled and one to which reference will be gratefully made for years to come.

The final chapter presents a useful listing of all the governmental departments and agencies with which hospital administrators have to deal.

In short, this is primarily a reference book of great value for the planning of hospital development, illustrated with well explained charts and tables graphically showing the wide variation of hospital facilities and services in the different states. A practical yardstick for measuring hospital-bed needs, in the bed-death ratio, and future development and expansion for both urban and rural communities is intelligently discussed. Finally, there is an interesting and instructive history of hospital development in the United States.

NOTICES

ANNOUNCEMENTS

Dr. Robert L. Cook announces the removal of his office to 38 Russell Park, Quincy.

Dr. Edward H. Hommel announces the removal of his office to 196 Dorchester Street, South Boston.

Dr. Samuel B. Kirkwood announces the removal of his office for the practice of obstetrics and gynecology to 1180 Beacon Street, Brookline.

Dr. Samuel Orlov announces the removal of his office for the practice of general medicine to 10 Reland Street, Middleboro.

Dr. Philip E. A. Sheridan announces the removal of his office to 80 Bay State Road, Boston.

Drs. Jacob H. Swartz and Earl A. Glicklich announce the removal of their office to 422 Beacon Street, Boston, for the practice of skin diseases.

BOSTON MEDICAL HISTORY CLUB

A meeting of the Boston Medical History Club will be held in Sprague Hall, Boston Medical Library, 8 Fenway, on Monday, January 12, at 8:15 p.m. I. Bernard Cohen, Ph.D., instructor in the history of science and general education, Harvard University, and managing editor of *Isis*, will speak on the subject "Some Scientific and Medical Aspects of Benjamin Franklin in Relation to Medicine and Science."

All interested persons are cordially invited to attend.

NEW ENGLAND HEART ASSOCIATION

A meeting of the New England Heart Association will be held at the Peter Bent Brigham Hospital, Boston, on Monday, January 26, at 8:15 p.m., with Dr. Samuel A. Levine presiding.

PROGRAM

Auscultatory Findings in Auricular Flutter. Drs. W. Proctor Harvey and Samuel A. Levine.

Studies on Cardiac Tamponade. Drs. H. Hellems, J. M. Evans and Lewis Dexter.

Present Status of Surgical Treatment of Coarctation of the Aorta. Dr. Robert E. Gross.

Wolff–Parkinson–White Syndrome and Myocardial Infarction with Demonstration of Anomalous Bundle. Drs. Harold D. Levine and J. C. Burge, Jr.

Physiological Studies on Eisenmenger's Complex. Drs. James Dow, Eugene C. Eppinger and C. Sidney Burwell.

A Neglected Form of Reversible Heart Failure. Drs. Edward Phillips and Samuel A. Levine.

Interested physicians and medical students are cordially invited to attend.

NORFOLK DISTRICT MEDICAL SOCIETY

A meeting of the Norfolk District Medical Society will be held at the Boston Medical Library, 8 Fenway, Boston, on Tuesday, January 27, at 8 p.m. A panel discussion on bleeding from the alimentary tract will be led by Dr. Arthur W. Allen, assisted by Drs. Franklin W. White, Richard B. Cattell, Thomas H. Lanman and Robert R. Linton, followed by a period of questions from the floor. A collation will be served.

All physicians are invited.

ELLA SACHS PLOTZ FOUNDATION FOR THE ADVANCEMENT OF SCIENTIFIC INVESTIGATION

During the twenty-fourth year of the Ella Sachs Plotz Foundation for the Advancement of Scientific Investigation, fifty-two applications for grants were received by the Trustees, twenty-one of which came from the United States, the other thirty-one coming from thirteen different countries in Europe, Asia and North and South America. Twenty-six grants were distributed.

Applications for grants to be held during the year 1948–1949 must be in the hands of the Executive Committee before April 15, 1948. There are no formal application blanks, but letters asking for aid must state definitely the qualifications of the investigator, an accurate description of the research, the size of the grant requested and the specific use of the money to be expended. In their requests for aid applicants should state whether or not they have approached other foundations for financial assistance and what other sources of support are relied on for research. It is highly desirable to include letters of recommendation from the directors of the departments in which the work is to be done. Only applicants complying with the above conditions will be considered. Applications should be sent to Dr. Joseph C. Aub, Massachusetts General Hospital, Fruit Street, Boston 14.

SOCIETY MEETINGS AND CONFERENCES

CALENDAR OF BOSTON DISTRICT FOR THE WEEK BEGINNING THURSDAY, JANUARY 15

FRIDAY, JANUARY 16

*9:00–10:00 a.m. Diagnosis of Thyroid Deficiency and the Use of Thyroid Hormone Therapy in Infants, Children and Adolescents. Dr. Nathan B. Talbot. Joseph H. Pratt Diagnostic Hospital.

*10:00 a.m.–12:00 m. Medical Staff Rounds. Peter Bent Brigham Hospital.

MONDAY, JANUARY 19

*12:15–1:15 p.m. Clinicopathological Conference. Peter Bent Brigham Hospital.

TUESDAY, JANUARY 20

12:00 m. X-Ray Conference. Margaret Jewett Hall, Mt. Auburn Hospital, Cambridge.

*12:15–1:15 p.m. Clinicoroentgenological Conference. Peter Bent Brigham Hospital.

WEDNESDAY, JANUARY 21

*9:00–10:00 a.m. Recurrent Spontaneous Pneumothoraces and Their Surgical Treatment. Dr. Francis M. Woods. Joseph H. Pratt Diagnostic Hospital.

*12:00 m. Grand Rounds and Clinicopathological Conference (Children's Hospital). Amphitheater, Peter Bent Brigham Hospital.

*2:00–3:00 p.m. Combined Clinic by the Medical, Surgical and Orthopedic Services. Amphitheater, Children's Hospital.

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*Open to the medical profession.

JANUARY–APRIL. Thirteenth Postgraduate Seminar in Neurology and Psychiatry. Metropolitan State Hospital. Page 348, issue of August 28.

JANUARY 12. Boston Medical History Club. Notice above.

JANUARY 13. New England Society of Anesthesiologists. Page 36, issue of January 1.

JANUARY 13. Harvard Medical Society. Page 36, issue of January 1.

JANUARY 14. Phi Delta Epsilon Lecture. Page 968, issue of December 18.

JANUARY 20 AND 21. American College of Surgeons. Commodore Perry Hotel, Toledo, Ohio. Page 930, issue of December 11.

JANUARY 26. New England Heart Association. Notice above.

JANUARY 26 AND 27. American College of Surgeons. Ansley Hotel, Atlanta, Georgia. Page 930, issue of December 11.

JANUARY 27. Norfolk District Medical Society Notice above.

JANUARY 30 AND 31. American College of Surgeons. Oklahoma Biltmore Hotel, Oklahoma City. Page 930, issue of December 11.

JANUARY 30 AND 31. Conference on Normal and Pathologic Physiology of Pregnancy. Page 1004, issue of December 25.

FEBRUARY 6. American Board of Obstetrics and Gynecology. Page 36, issue of January 1.

FEBRUARY 12. Slipping of Upper Femoral Epiphysis. Dr. John A. Reidy. Pentucket Association of Physicians. 8:30 p.m. Haverhill.

FEBRUARY 23–28. Postgraduate Assembly in Endocrinology. Page 36, issue of January 1.

MARCH 28–APRIL 4. American Association of Industrial Physicians and Surgeons, American Industrial Hygiene Association, American Conference of Governmental Industrial Hygienists, American Association of Industrial Nurses, Inc., and American Association of Industrial Dentists. Hotel Statler, Boston.

APRIL 19–23. American College of Physicians. Page xiii, issue of July 31.

MAY 6–8. American Association for the Study of Goiter. Page xiii, issue of July 31.

(Notices continued on page xv)